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INTRODUCTION

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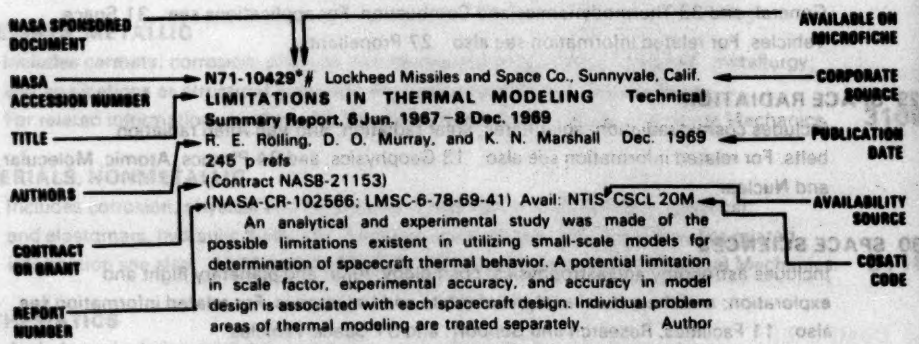
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An analytical and experimental study was made of the possible limitations existent in utilizing small-scale models for determination of spacecraft thermal behavior. A potential limitation in scale factor, experimental accuracy, and accuracy in model design is associated with each spacecraft design. Individual problem areas of thermal modeling are treated separately. Author

VOLUME 9 NUMBER 19 / OCTOBER 8, 1971

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N71-31658# Fraunhofer Institut, Freiburg (West Germany).
INVESTIGATION OF THE SUPERSONIC FLOW AROUND BLUNTED CONES WITH A SHARP LEADING EDGE [UNTERSUCHUNG DER UEBERSCHALLSTROEMUNG UM STUMPFE KEGEL MIT SCHARFKANTIGER SCHULTER]
H. Giesbrecht Feb. 1971 153 p refs In GERMAN; ENGLISH summary
(Rept-1/71) Avail: NTIS

The axisymmetric supersonic flow about blunt cones with a sharp edge is calculated by means of the Van Dyke inverse blunt-body-method and the method of characteristics. Two nose forms are investigated: a spherical cap and a pointed cone having a 40 deg semiangle. The results are compared with schlieren photos and shadowgraphs taken in a ballistic range. The existence of a secondary shock behind the sharp edge is discussed in detail. It is found that the flow outside a layer of increased entropy close to the wall becomes conical again. Whereas the pressure reaches the final value faster at low Mach numbers, the shock wave gets straight more quickly at higher Mach numbers. Disturbances at slender cones will still be felt at great distances from the nose.
Author (ESRO)

N71-31788# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Hauptabteilung Wissenschaft und Technik.
ON A NUMERICAL SOLUTION OF THE INTEGRAL EQUATION OF DUCTED PROPELLERS WITH A TIP CLEARANCE [ZUR NUMERISCHEN LOESUNG DER INTEGRALGLEICHUNG FUER MANTELSCHRAUBEN MIT SPALT]
Brigitte Overlech (Karlsruhe Univ.) 1971 39 p refs In GERMAN; ENGLISH summary
(DLR-FB-71-15) Avail: NTIS; DFVLR Porz: 11,60 DM

The vortex distribution on the duct of a ducted propeller results from a singular Fredholm integral equation of the first kind. If there is a small tip clearance, the right hand side of the integral equation behaves nearly like a logarithmic singularity so that the solution almost has a jump at the propeller location. A numerical method is presented, which is based on a coordinate transformation smoothing the discontinuous behavior of the solution. Furthermore, the result is compared with other methods by use of numerical examples.
Author (ESRO)

N71-31932# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AERODYNAMICS
D. M. Pritsker et al 23 Feb. 1971 283 p refs Transl. into ENGLISH of the book "Aerodinamika" Moscow, Izd. Mashinostr., 1968 p 1-310
(AD-723542; FTD-HC-23-840-70) Avail: NTIS CSCL 20/4

The text presents the fundamentals of the aerodynamics of modern aircraft. Laws governing the motion of the gas (air) and bodies in a gas flow are discussed; methods of applying these laws to a study of the aerodynamic characteristics of a wing, a propeller and the entire aircraft over a wide range of velocities are also discussed considering viscosity and compressibility of the flow. Also discussed are similarity laws for air flows, coordinate systems and aerodynamic coefficients expressing forces of interaction between the flow and the body, and the moments of these forces; formation of the boundary layer and control of it; aerodynamic heating of bodies and fundamentals of the aerodynamics of rarefied gases.
GRA

N71-32188*# Techtran Corp., Glen Burnie, Md.
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Stephan G. Procluk Washington NASA Aug. 1971 32 p refs Transl. into ENGLISH from Visti Ukr. Inzh., v.20, no. 4, 1969 p 72-87
(Contract NASw-2037)
(NASA-TT-F-12878) Avail: NTIS CSCL 01A

A review of developments in Ukrainian science and technology during the 1920's and early 1930's is presented, emphasizing progress in the fields of aeronautics and aircraft construction and design. The involvement of many Ukrainian scientists in the work of the Central Aerohydrodynamic Institute in Moscow is discussed. The point is also made that number of major contributors were Ukrainians and not Russians. The development of aviation schools, particularly those in Kharkow and Kiev, and construction factories is also summarized.
Author

N71-32211*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AERODYNAMIC CHARACTERISTICS AT MACH NUMBERS FROM 1.60 TO 2.16 OF A BLUNT-NOSE MISSILE MODEL HAVING A TRIANGULAR CROSS SECTION AND FIXED TRIFORM FINS
William J. Monta Washington Aug. 1971 27 p
(NASA-TM-X-2340; L-7179) Avail: NTIS CSCL 01A

A wind tunnel investigation has been conducted to determine the aerodynamic characteristics of a triform finned missile configuration having a body of triangular cross section and a

flat-faced nose. The investigation included the effects of nose corner radius, fin span, and fin asymmetry for providing rolling moment. The tests were conducted at Mach numbers of 1.60, 1.75, and 2.16, for a unit Reynolds number of 8.2 × 1 million per meter (2.5 × 1 million per foot). The angle of attack was varied from about −6 deg to 20 deg for a series of model roll orientations between 0 deg and 180 deg. Author

N71-32222# RAND Corp., Santa Monica, Calif.
NEAR-FREE MOLECULE DRAG OF SLENDER CONES
D. R. Willis Dec. 1970 56 p refs
(P-4521) Avail: NTIS

A flight regime is considered for a slender pointed cone where the first effects on drag of intermolecular collisions between gas molecules which have already struck a body surface, and freestream molecules, appear. The phenomena correspond to hypersonic reentry into the upper atmosphere, where the first corrections to the traditional free-molecule drag coefficient are likely to be significant. Author

N71-32237# Sandia Corp., Albuquerque, N.Mex.
NONLINEAR PITCHING MOTION OF MISSILES
John K. Kryvoruka Mar. 1971 60 p refs
(Contract AT(29-1)-789)
(SCL-RR-70-119) Avail: NTIS

A nonlinear theory describing planar, free-oscillatory motion of missiles is presented. Approximate solutions to the nonlinear differential equation of motion in which the aerodynamic damping and restoring moments are finite polynomial functions of the angle of attack are obtained by equivalent linearization methods. Accuracy and range of applicability are shown by comparing approximate with exact solutions for special cases of the nonlinear equation. In addition, a discussion and analysis of the effects of secondary harmonic frequencies introduced by nonlinearities are also presented. In each case, the theory and analysis techniques are applied to simulated nonlinear motions by a differential corrections, curve fitting technique. The result is a highly accurate determination of various linear and nonlinear stability coefficients. Author

N71-32246*# National Aeronautics and Space Administration, Washington, D.C. Library of Congress, Washington, D.C.
ASTRONAUTICS AND AERONAUTICS, 1969 Chronology on Science, Technology, and Policy
1970 539 p refs Prepared by Library of Congr. Sci. and Technol. Div.
(NASA-SP-4014) Avail: SOD $2.25; NTIS CSCL 01A

The brief, chronological record of 1969 events in aerospace science, technology, and policy has been prepared as events occurred and were reported in the immediately available, open sources—the news media, press releases, speech texts, transcripts, testimony before Congress, and test and study reports. A first collection of clues to significant occurrences and background climate for future historians, the volume is also intended to serve for immediate reference uses. It does not attempt to analyze but to cite the who, what, when, and where in sequence and as near real time as possible. Author

N71-32307*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LIFT INDUCED ON A SWEPT WING BY A TWO-DIMENSIONAL PARTIAL-SPAN DEFLECTED JET AT MACH NUMBERS FROM 0.20 TO 1.30
Blake W. Corson, Jr., Francis J. Capone, and Lawrence E. Putnam Washington Aug. 1971 66 p refs
(NASA-TM-X-2309; L-7707) Avail: NTIS CSCL 01A

An exploratory investigation was conducted in the 16-foot transonic tunnel at Mach numbers from 0.20 to 1.30 to determine the induced lift characteristics of a body and swept-wing configuration having a partial-span two-dimensional propulsive nozzle with exhaust exit in the notch of the swept-wing trailing edge. The effects on wing-body characteristics of deflecting the propulsive jet in the flap mode at nominal exhaust-nozzle deflection angles from 0 to 30 deg were studied. The Reynolds number based on wing mean geometric chord varied from 1.35 million to 3.66 million. Author

N71-32388*# Honeywell, Inc., St. Paul, Minn. Systems and Research Div.
FEASIBILITY STUDY OF A BIDIRECTIONAL JET FLAP DEVICE FOR APPLICATION TO HELICOPTER ROTOR BLADES, PHASE 1 Final Report, 6 Jun. 1967–3 Oct. 1969
R. E. Rose, J. M. Hammer and A. P. Kizilos Jul. 1971 157 p refs
(Contract NAS2-4389)
(NASA-CR-114359; Rept-12081-FR1) Avail: NTIS CSCL 01B

A bidirectional jet flap device called the Variable Deflection Thruster (VDT) has been investigated for possible application to helicopter rotors. The study is part of a long-range program to develop blown control techniques for stabilizing the higher harmonic modes of helicopter rotors. A three-sectioned, two-dimensional VDT-blade model was designed with individually controlled VDT jet flaps in each section. Steady-state wind tunnel tests were conducted with various combinations of VDT-blade section blowing and with the VDT-blade center section only. Dynamic tests were conducted with the VDT jet oscillating at various frequencies. Fair agreement was obtained between theory and experimental results. The results show that the VDT is an effective lift-producing device with simultaneous drag reduction. The VDT-blade lift can be sensed from the differential pressure at midchord. This pressure signal can be amplified using fluidic circuitry and used to automatically control the VDT-blade lift. The dynamic results indicate that the ratio of dynamic lift to steady-state lift increases with increased VDT jet oscillation frequency for a constant oscillation angle. It is indicated that the dynamic response of the VDT device is less than 8 msec (corresponding to a phase angle of approximately 0.5 radian) for a jet oscillation frequency of 10 Hz. Author

N71-32463*# Nielsen Engineering and Research, Inc., Mountain View, Calif.
THEORETICAL INVESTIGATION OF THE AERODYNAMIC INTERFERENCE INDUCED BY CRUISE AND LIFT FANS ON TRANSPORT-TYPE AIRCRAFT
M. R. Mendenhall, M. F. E. Dillenius, and S. B. Spangler Washington NASA Aug. 1971 92 p refs
(Contract NAS2-5247)
(NASA-CR-1730) Avail: NTIS CSCL 01B

Potential flow theory was applied to two configurations characteristic of transport-type aircraft: a wing-pylon-high bypass ratio turbofan arrangement and a lifting fan adjacent to a wing. For the wing-pylon, a nonplanar, vortex lattice, lifting surface method was developed. For the turbofan engine and lift fan, a ring vortex model was used, with exhaust wake curvature handled by the addition of a sink and doublet distribution along the wake centerline. Comparisons with force and pressure distribution data for wing alone, wing-pylon, wing-pylon-engine, and wing-lifting jet configurations are presented to illustrate the nature of the interference effects and to assess the accuracy of the methods. Author

N71-32466*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RADIAL IN-FLOW TURBINE PERFORMANCE WITH EXIT DIFFUSERS DESIGNED FOR LINEAR STATIC PRESSURE VARIATION
William J. Nusbaum and Milton G. Kofskey Washington Aug. 1971 22 p refs
(NASA-TM-X-2357; E-6276) Avail: NTIS CSCL 21E

Two alternative turbine exit diffusers were designed with an area ratio identical to that of the original but with a significantly different axial static-pressure variation. These two diffusers had the

same flow area variation; they differed only in the contours of the inner and outer walls. Each diffuser was tested as part of the turbine with cold argon at design Reynolds number. Overall total-to-total efficiency for operation at the design point with either of the two alternative diffusers was about 0.906 as compared to 0.894 for operation with the original. The diffuser loss was reduced from 0.019 to 0.007 in terms of overall total efficiency. Author

N71-32511*+ National Aeronautics and Space Administration, Washington, D.C.
AERONAUTICAL ENGINEERING: A SPECIAL BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 5)
May 1971 188 p
(NASA-SP-7037(05)) Avail: NTIS CSCL 01B

This special bibliography lists 570 reports, articles, and other documents introduced into the NASA scientific and technical information system in April 1971. Emphasis is placed on engineering and theoretical aspects for design, construction, evaluation, testing, operation, and performance of aircraft (including aircraft engines) and associated components, equipment, and systems. Entries on research and development in aeronautics and aerodynamics, and research and ground support for aeronautical vehicles are also included. Author

N71-32532 National Lending Library for Science and Technology, Boston Spa (England).
HEAT TRANSFER AND AERODYNAMICS OF STAGGERED TUBE BUNDLES WITH A TRANSVERSE FLOW OR AIR IN THE REYNOLDS NUMBER REGION Re > 100000
Yu. K. Stasyulyavichyus et al Feb. 1971 12 p refs Transl. into ENGLISH from Inzh.-Fizhk. Zh. (Minsk), v. 7, no. 11 1964 p 10–15
(NLL-RTS-5989) Avail: Natl. Lending Library, Boston Spa, Engl.: £1.00; 3 NLL photocopy coupons

Results are given of experimental studies of heat transfer and aerodynamics resistance of staggered smooth-tube, seven-row bundles in the range a/b = 1.27 – 1.94, in the Reynolds number range from 10 to the 4th power to 2 × 10 to the 6th power. Criterial relationships are given for calculating the mean heat transfer and aerodynamic resistance of smooth-tube, staggered bundles within this range. Author

N71-32719*# National Aeronautics and Space Administration, Washington, D.C.
FLIGHT DYNAMICS IN MOVING AIR
Yu. P. Dobrolenskiy Jul. 1971 284 p refs Transl. into ENGLISH of the book "Dinamika Poleta v Nespokoynoy Atmosfere" Moscow, Mashinostroyeniye Press, 1969
(NASA-TT-F-600) Avail: NTIS CSCL 01A

The characteristics of flight dynamics, the result of air motion with respect to the ground are presented. Particular attention is given to the influence of turbulent air motion on airplane flight. An analytical evaluation of the action of a discrete rectangular wind gust is provided simultaneously in many of the cases considered. The results of the analytical investigation of the motion of an airplane in turbulent air are compared with data obtained from in-flight experiments. Information on the kinematics of turbulent air motion is systematized, and methods used to describe this motion analytically are reviewed. A method for obtaining equations for the longitudinal and lateral motions of the airplane with the wind taken into consideration is described in detail. Transfer functions for parameters characterizing the movement of the center of gravity, as well as the angular motions of the airplane acted on by gusts, are derived. These transfer functions are then used to evaluate steady-state motion of the airplane acted on by discrete rectangular gusts. Author

N71-32792*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
CALCULATION OF SUPERSONIC FLOWS AT LARGE DISTANCES FROM SLENDER LIFTING BODIES
Michael Schorling Washington Aug. 1971 48 p refs
(NASA-TN-D-6446; L-7728) Avail: NTIS CSCL 01A

The exact gasdynamical equations are solved far from the axis of a slender body flying at an angle of incidence. The boundary conditions are obtained from slender-body theory. The solution allows one to make a prediction of the strength of the sonic boom as well as the position of the shock waves. Author

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N71-31611# Civil Aeronautics Board, Washington, D.C. Costs and Statistics Div.
AIRCRAFT OPERATING COST AND PERFORMANCE REPORT. VOLUME 4: FOR CALENDAR YEARS 1968 AND 1969
Aug. 1970 135 p refs
Avail: SOD $2.25

Unit cost and performance data are presented for transport aircraft operated by the Nation's certificated route air carriers during the 12 months ended December 31, 1968 and the 12 months ended December 31, 1969. Unit operating cost and performance data for turbine aircraft operated by the U.S. supplemental air carriers during the 12 months ended December 31, 1969 are also presented. Author

N71-31663# Battelle Memorial Inst., Columbus, Ohio. Defense Metals Information Center.
CONCEPTS IN FAIL-SAFE DESIGN OF AIRCRAFT STRUCTURES
David Broek Mar. 1971 22 p refs
(Contract F33615-71-C-1067)
(AD-723317; DMIC-Memo-252) Avail: NTIS CSCL 1/3

In order to obtain an appraisal of the state of the art of fail-safe design, the author made an inventory of fail-safe design methods applied by various aerospace companies and of research work relevant to the engineering approach of fatigue-crack propagation and residual strength. This memorandum is based on information from discussions with personnel of several companies and research laboratories, with the main emphasis on plane stress and transitional fracture behavior. The memorandum presents a brief description of the general approach to the fail-safe problem, an analysis of several of the existing methods that use this approach, including their shortcomings, and a summary of the data required for a good fail-safe design. A specific approach proposed for the presentation in MIL-HDBK-5 of data pertinent to the fail-safe design concept is evaluated in terms of its applicability to that concept. Author (GRA)

N71-31771# Army Foreign Science and Technology Center, Charlottesville, Va.
HELICOPTERS IN THE NATIONAL ECONOMY
V. I. Biryulin et al 12 Mar. 1971 205 p Transl. into ENGLISH of the book "Vertolety V Narodnom Khozyaistre" Moscow, Transport Press, 1969 p 1–176
(AD-723594; FSTC-HT-23-1137-70) Avail: NTIS CSCL 1/3

This book summarizes the experiences of the use of helicopters in the national economy. Flying-technical and economic characteristics of helicopters are studied from the standpoint of their use in various branches of the national economy of the USSR. Problems of the operation of helicopters without heliports under various geographic and climatic conditions are discussed. The requirements placed on helicopters designed for various purposes and the prospects for the improvement of helicopters are discussed. This book is designed for flying and engineering-technical personnel, workers of enterprises and organizations, ministries and departments where helicopters are used. GRA

N71-31772# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

AVIATION VERSUS SUBMARINES

I. M. Sotnikov et al 1 Mar. 1971 232 p refs Transl. into ENGLISH of the book "Aviats. Protiv Podvodnykh Lodok" Moscow, Izd-Vo Min. Oborony SSSR, 1970 206 p

(AD-723558; FTD-MT-24-02-71) Avail: NTIS CSCL 15/1

The contemporary state and the means of developing antisubmarine aircraft, helicopters and airships of capitalist governments, and also the aviation means of detecting and destroying submarines, or organizing conflicts with submarines, the methods of operational utilization and tactical application of aircraft in antisubmarine operations are reviewed. Author (GRA)

N71-31779# Air Pollution Control District, Los Angeles, Calif.

STUDY OF JET AIRCRAFT EMISSIONS AND AIR QUALITY IN THE VICINITY OF THE LOS ANGELES INTERNATIONAL AIRPORT

Apr. 1971 190 p

(Contract CPA-22-69-137)

(PB-198699; APTD-0662) Avail: NTIS CSCL 13B

The results of an investigation of the impact of jet aircraft operations on the air environment in the vicinity of a major air terminal are presented. The study, made at Los Angeles International Airport during the period of June 30, 1969, through November 18, 1970, had the following objectives: to determine total pollutant emissions from aircraft and ground operations at a major airport; to conduct exhaust measurements on the Pratt and Whitney JT4A and JT9D engines to complete the available exhaust emission data for gas turbine engines; to measure atmospheric concentrations of pollutants at ground level within and around a major airport; and, to determine the carbon monoxide exposure in an aircraft cabin during all ground operations. GRA

N71-31782# Tracked Hovercraft, Ltd., London (England).

A COST COMPARISON OF THREE TRACKED AIR CUSHION VEHICLE CONFIGURATIONS Final Report

Jul. 1970 370 p refs

(Contract DOT-FR-9-0032)

(PB-197501; FRA-RT-71-68) Avail: NTIS HC $6.00/MF $0.95 CSCL 13F

A comparison is made of vehicle systems, using box, inverted-tee and channel cross section tracks. Each system is adapted to meet a common specification, which required 100 passenger, electrically powered, vehicles operating at 250 mph on an elevated guideway. The comparison is divided into sections: guideway assessment, vehicle design and performance, total system performance, and an essay on the concept of single-sided linear induction motors. Vehicle power requirements are based on a simple form of peripheral jet air-cushion suspension system which can be expected to be improved upon. Even with this assumption it is shown that the box track system would have the lowest total annual cost to an operator, due to the substantially lower costs of the box guideway. Author (GRA)

N71-31793# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.

EFFECTS OF SST TAKEOFF PROCEDURES ON NOISE EXPOSURE, AND REVIEW OF EPNL VARIATIONS WITH DISTANCE

Apr. 1971 57 p refs

(Contract DOT-FA-SS-71-8)

(AD-722366; BBN-2090) Avail: NTIS CSCL 20/1

The report summarizes the results of a study of noise exposure from supersonic transport (SST) operations and the estimation of changes in SST noise levels with distance, from currently available data. The report is presented in two parts. Part I describes a study of the effects of SST takeoff operational procedures on aircraft noise exposure for a simplified airport situation. Factors considered include aircraft mix, takeoff climb profiles and aircraft noise levels. Part II discusses methods of estimating variations of effective perceived noise level (EPNL) with slant distance for SST aircraft. Emphasis is placed on estimating these noise levels at large distances between the aircraft and the observer. Author (GRA)

N71-31805# Los Angeles Maintainability Association, Van Nuys, Calif.

MAINTAINABILITY SEMINAR

1 May 1971 119 p refs Conf. held at Inglewood, Calif., 1 May 1971

(AD-723227) Avail: NTIS CSCL 14/4

The lectures are centered around the entire spectrum of maintainability engineering which includes planning, requirements, allocation, design liaison, predictions, demonstration procedures, data analysis, collection, and corrective action procedures. The series are centered around a single seat Attack/Fighter aircraft. Author (GRA)

N71-31815# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.

AIRCRAFT, FIXED AND ROTARY WING Final Report

19 Mar. 1971 40 p refs

(AD-723411; MTP-7-3-021) Avail: NTIS CSCL 1/3

The procedure defines methods of evaluating performance of rotary and fixed wing aircraft in all phases of employment from ground handling to flight operations. Author (GRA)

N71-31882# Deutsche Gesellschaft fuer Luft- und Raumfahrt, Cologne (West Germany).

TURBULENCE MODEL AT LOW ALTITUDES AND FLIGHT IN A TURBULENT ATMOSPHERE [TURBULENZMODELL IN BODENNAEHE UND FLUG IN TURBULENTER ATMOSPHAEHRE]

Dec. 1970 163 p refs In GERMAN; ENGLISH summary Presented at the Meeting of the DGLR Sci. Comm. on Flight Performance and Trajectories and Flight Characteristics, Darmstadt, West Ger., 12–13 Nov. 1970

(DLR-MITT-70-12) Avail: NTIS; ZLDI Munich: 34 DM

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1. THE STRUCTURE OF ATMOSPHERIC TURBULENCE NEAR EARTH'S SURFACE W. Klug (Tech. Hochschule, Darmstadt) p 7–20 refs (See N71-31883 19-20)

2. A MEASUREMENT SET-UP FOR DETERMINING ATMOSPHERIC TURBULENCE I. Schmidt (Luftwaffenamt) p 21–28 (See N71-31884 19-20)

3. SYNOPTIC AEROLOGICAL CONDITIONS FOR THE OCCURRENCE OF CLEAR AIR TURBULENCE F. Weber (DFVLR, Oberpfaffenhofen) p 29–54 refs (See N71-31885 19-20)

4. DIGITAL SIMULATION OF RANDOM PERTURBATION VARIABLES (Tech. Hochschule, Darmstadt) p 55–86 (See N71-31886 19-08)

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CALCULATION OF THE STANDARD DEVIATION OF BALLISTIC MISSILES B. Weissenbach (Messerschmitt-Boelkow-Blohm, Ottobrunn) p 87-97 (See N71-31887 19-20)

6. ON THE QUESTION OF PILOT INJURY DURING LOW ALTITUDE FLIGHT P. Schulz (Ver. Flugtech. Werke-Fokker, Bremen) p 99-117 refs (See N71-31888 19-05)

7. A SIMPLE CRITERION FOR REDUCTION OF MULTIPLE GUST LOADS WITH ACCELERATION CONTROL P. Hamel (Messerschmitt-Boelkow-Blohm, Ottobrun) and U. Graeberds (Messerschmitt-Boelkow-Blohm, Ottobrun) p 119-135 refs (See N71-31889 19-02)

8. COMPARISON OF THE INFLUENCE OF HORIZONTAL AND VERTICAL GUST INTERFERENCES ON AIRCRAFT LONGITUDINAL MOTION G. Schaenzer (Bodenseewerk Geraetetech.) p 137-141 refs (See N71-31890 19-02)

9. SIMULATION OF ATMOSPHERIC TURBULENCE, IN PARTICULAR ITS INFLUENCE ON AIRCRAFT YAWING MOTION W. Schattenmann (DFVLR, Oberpfaffenhofen) p 143-159 refs (See N71-31891 19-02)

N71-31889# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).

A SIMPLE CRITERION FOR REDUCTION OF MULTIPLE GUST LOADS WITH ACCELERATION CONTROL [EIN EINFACHES KRITERIUM ZUR VERMINDERUNG DER BOEENLASTVIELFACHEN MITTELS BESCHLEUNIGUNGSREGELUNG]

P. Hamel and U. Graeber *In* DGLR Turbulence Model at Low Altitudes and Flight in a Turbulent Atmosphere Dec. 1970 p 119-135 refs In GERMAN (See N71-31882 19-02)
Avail: NTIS; ZLDI Munich: 34 DM

The possibility of an acceleration control for the reduction of multiple loads produced by air turbulence is investigated. It is found that the method of tune lift control results in the most optimal gust load reduction. ESRO

N71-31890# Bodenseewerk Geraetetechnik G.m.b.H., Ueberlingen (West Germany).

COMPARISON OF THE INFLUENCE OF HORIZONTAL AND VERTICAL GUST INTERFERENCE ON AIRCRAFT LONGITUDINAL MOTION [VERGLEICH DER EINFLUESSE HORIZONTALER UND VERTIKALER BOEENSTOERUNGEN AUF DIE FLUGZEUGLAENGSBEWEGUNG]

G. Schaenzer *In* DGLR Turbulence Model at Low Altitudes and Flight in a Turbulent Atmosphere Dec. 1970 p 137-141 refs In GERMAN (See N71-31882 19-02)
Avail: NTIS; ZLDI Munich: 34 DM

In determining the influence of gust loads on a noncontrolled longitudinal aircraft motion, it is shown to be necessary to take into account horizontal and vertical gust components, their frequencies and power spectra. ESRO

N71-31891# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.

SIMULATION OF ATMOSPHERIC TURBULENCE, IN PARTICULAR ITS INFLUENCE ON AIRCRAFT YAWING MOTION [SIMULATION DER ATMOSPHAERISCHEN TURBULENZ, INSBESONDERE DEREN EINFLUSS AUF DIE FLUGZEUGSEITENBEWEGUNG]

W. Schattenmann *In* DGLR Turbulence Model at Low Altitudes and Flight in a Turbulent Atmosphere Dec. 1970 p 143-159 refs In GERMAN (See N71-31882 19-02)
Avail: NTIS; ZLDI Munich: 34 DM

An atmospheric turbulence model according to Military Specification F 8785 A (USAF) is analyzed. It is shown that the dominant aircraft yaw motion is determined by the lateral gust velocity component and asymmetric vertical gust velocity component. ESRO

N71-31933# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

AN INVESTIGATION OF THE APPLICABILITY OF LINEAR OPTIMAL CONTROL THEORY TO AIRCRAFT CONTROL SYSTEM DESIGN

Ancel R. Sherrard (M.S. Thesis) Mar. 1971 134 p refs
(AD-722662; GGC/EE/71-22) Avail: NTIS CSCL 1/3

Using steady-state linear regulator theory a longitudinal feedback control system is found for a hypothetical high-performance aircraft that operates through a wide range of Mach number and dynamic pressure. The aircraft stability derivatives vary statistically and the aircraft measurement sensors are affected by body bending responses. Linear approximations of the optimal feedback law gains are programmed as functions of Mach number and dynamic pressure, and the normal-acceleration elevator-step-response of the closed-loop aircraft is simulated. The simulated step responses are compared to a normal acceleration step response criterion envelope that is specified in the 1970 Joint Automatic Control Conference (JACC) Design Challenge. Author (GRA)

N71-31934# Boeing Co., Wichita, Kans.

PIVOTING WING RIDE SMOOTHING/FLUTTER SAS ANALYSIS Summary Report

Walter J. Wattman and James L. Townsend 3 May 1971 71 p refs
(AD-723321; D3-8597) Avail: NTIS CSCL 1/3

Rigid body studies conducted by Battelle and NASA-Langley have indicated that free floating pivoting wings can significantly reduce turbulence induced vertical accelerations. However, NASA-Langley has shown that a flexible pivoting wing can have an unacceptably low flutter speed. Presented in this document are the results of an analytical follow-on study conducted to determine the feasibility of increasing the flutter speed with an active or passive flutter stability augmentation system (SAS) while retaining significant ride smoothing capability. Author (GRA)

N71-31940# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.

SAFETY Final Report

1 Mar. 1971 35 p refs
(AD-723033; MTP-7-3-506) Avail: NTIS CSCL 1/3

Procedures are described for identifying safety hazards associated with aircraft armament, airframe, ejection seat, electrical systems, and mechanical systems. Checklists are furnished. Author (GRA)

N71-31960# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Unternehmensbereich Drehfluegler.

V/STOL TECHNIQUE AS AN APPLICATION FIELD OF IN-FLIGHT SIMULATION [V/STOL-TECHNIK ALS ANWENDUNGSGEBIET FUER DIE SIMULATION IM FLUG]

K. Janik *In* DGLR Flight Mech. Simulation, Ground Based or In-flight May 1971 p 237-253 refs In GERMAN; ENGLISH summary (See N71-31951 19-11)
Avail: NTIS; ZLDI Munich: 53.15 DM

It is shown that the problems of mission-oriented handling qualities of future V/STOL aircraft can best be solved by means of in-flight simulation. THE MBB-BO 105 light helicopter with hingeless rotor is described as being particularly suited for the simulation. Author (ESRO)

N71-32077# National Aviation Facilities Experimental Center, Atlantic City, N.J.

CRASH RESISTANT FUEL SYSTEMS DEMONSTRATIONS AND EVALUATION Final Report, 1968-1970

Hugo P. Scheuerman Aug. 1971 31 p refs
(FAA-NA-71-34; FAA-RD-71-27) Avail: NTIS

A crash-resistant bladder fuel tank system incorporating crash actuated valves and crash-resistant bladder material was impact tested in full-scale wing assemblies. The tests were conducted under realistic crash load conditions simulating survivable accidents at approximately 25 mph to 75 mph. Weight and volume changes incurred by the crashworthy features installed are outlined. Author

N71-32080# Federal Aviation Administration, Oklahoma City, Okla. Civil Aeromedical Inst.

AEROMEDICAL TRANSPORTATION AND GENERAL AVIATION

Harry L. Gibbons and Carl Fromhagen Apr. 1971 11 p refs
(FAA-AM-71-18) Avail: NTIS

Fixed-wing secondary ambulance service is growing at a rapid rate without the benefit of studies such as those pertaining to helicopter primary ambulance service. Problems associated with this growth relate to equipment, crew training, and knowledge of the physiology of flight. Legislative and/or education efforts are needed to assure optimum general aviation patient transportation. Author

N71-32086# Federal Aviation Administration, Washington, D.C.

SECOND FEDERAL AIRCRAFT NOISE ABATEMENT PLAN, FY 1970–1971

Jan. 1971 65 p refs
Avail: SOD $0.65; NTIS

The causes of aircraft noise and programs to reduce the disturbances caused by aircraft noise are discussed. Subjects presented are: (1) milestones in noise abatement, (2) aircraft noise and the urban environment, (3) sonic boom phenomenon, and (4) research and development programs, government and non-government supported, for noise abatement. Author

N71-32306# National Aviation Facilities Experimental Center, Atlantic City, N.J.

INERTED FUEL TANK OXYGEN CONCENTRATION REQUIREMENTS Interim Report, Jan.–Mar. 1971

Samuel V. Zinn, Jr. Aug. 1971 21 p refs
(FAA-NA-71-28; FAA-RD-71-42) Avail: NTIS

A literature search was conducted to investigate the extent of experimental work and studies that were performed for determining and evaluating safety parameters of jet fuels in aircraft tanks when using nitrogen as a inerting agent. The search revealed that extensive laboratory studies have been made during the past 30 years and that safety zones can be predicted over a wide range of conditions and environments. As a conclusion from this search, it is considered that an oxygen content up to 9 percent in the effluent obtained by nitrogen inerting will produce an incombustible environment. Author

N71-32389*# Princeton Univ., N.J. Dept. of Aerospace and Mechanical Sciences.

FULL-SCALE WIND TUNNEL TESTS OF A LOW-WING, SINGLE-ENGINE, LIGHT PLANE WITH POSITIVE AND NEGATIVE PROPELLER THRUST AND UP AND DOWN FLAP DEFLECTION

Edward Seckel and James J. Morris Washington NASA Aug. 1971 152 p ref
(Contract NAS1-9443)
(NASA-CR-1783; Rept-922) Avail: NTIS CSCL 01B

Full scale wind tunnel data for a low-wing single-engine light airplane, with up and down flap deflections and a range of negative through positive propeller thrust, are presented. The data are analyzed to determine the effects of flap deflection, propeller thrust and angle-of-attack on the aerodynamic characteristics of the airplane. Longitudinal and lateral directional static stability, control, and trim characteristics are considered in some detail. Author

N71-32370*# Northrop Corp., Hawthorne, Calif.

MODEL TESTS OF CONCEPTS TO REDUCE HOT GAS INGESTION IN VTOL LIFT ENGINES

Gordon R. Hall Washington NASA Jul. 1971 157 p refs
(Contract NAS3-10498)
(NASA-CR-1863) Avail: NTIS CSCL 01B

An investigation was performed to determine the relative effectiveness of various exhaust gas ingestion suppression concepts for application to VTOL aircraft. The test model used in the investigation was a small-scale simulated VTOL lift engine pod containing two engines. Ingestion control concepts included: (1) shielding devices integral with the engine pod which act to deflect the reflected upwash gases away from the inlets; (2) concepts designed to alter the issuing exhaust jets (such as exhaust vectoring and jet suppression nozzles); and (3) ground plane platforms which alter the impingement process of the exhaust jets on the ground so that the potential upwash is laterally removed from the engine proximity. Effectiveness of the various ingestion control concepts was based on comprehensive measurements of the inlet thermal environment as well as upon the effect the concept had in altering the structure of the near flow field. The majority of concepts evaluated were found to be effective in producing major reductions in exhaust gas ingestion at low wind conditions. However, none were found to be totally effective in eliminating hot gas ingestion at all wind conditions tested, particularly with the model exposed to crosswinds. Author

N71-32447# Federal Aviation Administration, Oklahoma City, Okla. Civil Aeromedical Inst.

GENERAL AVIATION STRUCTURES DIRECTLY RESPONSIBLE FOR TRAUMA IN CRASH DECELERATIONS

John J. Swearingen Jan. 1971 217 p
(FAA-AM-71-3) Avail: NTIS

An analytical study of general aviation accident injuries is presented. Needs for improvement of both the crash design of the interior of the cockpit and the structural integrity of the cockpit itself are clearly illustrated. The author concludes, after many detailed analyses, that many present-day general aviation aircraft with their rigid instrument panels studded with heavy instruments, protruding knobs and sharp edges, along with a lack of slow-return padding and very inadequate restraint equipment, are producing fatal or very serious injuries during low cabin crash decelerations. Again based on the author's calculations, it is not uncommon for light aircraft cabins to start to disintegrate and/or collapse on the occupants if the crash forces exceed 9 or 10 g. And yet, some manufacturers have produced aircraft for aerial application that have cockpits that can withstand up to 40 g. Engineering design changes can sharply reduce the death and injury rate in general aviation accidents. Author

N71-32484+ National Transportation Safety Board, Washington, D.C.

ANNUAL REVIEW OF AIRCRAFT ACCIDENT DATA: US GENERAL AVIATION CALENDAR YEAR 1969

28 Apr. 1971 151 p
(NTSB-ARG-71-1) Avail: NTIS

The Annual Review of Aircraft Accident Data is a statistical compilation published by the National Transportation Safety Board. The publication contains statistical information compiled from reports of 4,767 General Aviation accidents that occurred during the calendar year 1969. Included in the total number of accidents are 45 collisions between aircraft. By coding each aircraft involved in the collisions, an additional 45 records are produced, bringing the total accidents to 4,812. This figure reflects the true number of pilots and aircraft involved in the accidents. Author

N71-32488*# Translation Consultants, Ltd., Arlington, Va.
MEASUREMENT OF PERFORMANCES: FLIGHT TESTING METHODS APPLIED TO THE CONCORDE [MESURE DES PERFORMANCES METHODES D'ESSAIS EN VOL APPLIQUEES A CONCORDE]
J. Tourraille et al Washington NASA Aug. 1971 46 p Transl. into ENGLISH from report presented at 38th Meeting of AGARD Flight Mechanics Group, Toulouse, 10-14 May, 1971 43 p
(Contract NASw-2038)
(NASA-TT-F-13728) Avail: NTIS CSCL 01B

A summary of the testing methods used for performance measurement of the Concorde aircraft is presented. Subjects discussed are: (1) trajectory plotting for determination of takeoff and landing trajectories, (2) calibration of the anemobarometric installation, (3) determination of operational performances by stabilizations and continuous method by accelerometry, and (4) calibration of the incidence and sideslip sensors. Author

N71-32456# National Bureau of Standards, Washington, D.C.
SIMULATION OF AIR TRAFFIC CONTROL RADAR BEACON CODE ASSIGNMENT PLANS Final Report
R. D. Elbourn and Judith F. Gilsinn Mar. 1971 76 p Sponsored by FAA and DOT
(NBS-TN-568) Avail: SOD $0.70

In the Air Traffic Control Radar Beacon System transponders in the aircraft use one of 4096 identity codes when replying to interrogation from the Secondary Surveillance Radar. Two types of plans for assigning identity codes to aircraft were tested by simulating in a digital computer a peak day's IFR traffic in the USA. In one type each Air Route Traffic Control Center assigns codes independently of all the others, while in the other type a single master center makes all the code assignments for the USA. Four other types of plans are discussed, and an assignment plan of mixed type is proposed for further study. The strategy of simulation and the use of the SIMSCRIPT language are discussed in an appendix. Author

N71-32460# National Transportation Safety Board, Washington, D.C.
NORTHEAST AIRLINES, INCORPORATED, McDONNELL DOUGLAS DC-9-31, N982NE, MARTHA'S VINEYARD, MASSACHUSETTS, 22 JUNE 1971
4 Aug. 1971 6 p
(SB-71-64) Avail: NTIS

An incident involving a Northeast Airlines DC-9 aircraft at Martha's Vineyard, Massachusetts on June 22, 1971 is reported. While on final approach to the airport, the aircraft struck the surface of the water and received minor damage. The aircraft flew to Boston, Massachusetts and made an airport landing without further incident. Author

N71-32491# National Transportation Safety Board, Washington, D.C.
A MIDAIR COLLISION INVOLVING A HUGHES AIR WEST DC-9-31, N9345, AND A MARINE CORPS McDONNELL F-4B (PHANTOM) BUREAU NO. 151458 4NM NNE OF DUARTE, CALIFORNIA, 6 JUNE 1971
26 Jul. 1971 13 p
(SB-71-62) Avail: NTIS

A report of the midair collision between a DC-9 commercial aircraft and a Marine Corps F-4B aircraft near Durate, California on June 6, 1971 is presented. The collision occured in daylight at an altitude of 15,150 feet above mean sea level. The radar observer in the military aircraft was the sole survivor. Author

N71-32500# National Transportation Safety Board, Washington, D.C.
ALLEGHENY AIRLINES, INCORPORATED ALLISON PROP JET CONVAIR 440, N8832, NEW HAVEN, CONNECTICUT, 7 JUNE 1971
3 Aug. 1971 13 p
(SB-71-65) Avail: NTIS

The results of the aircraft accident investigation following the crash of a Convair 440 at New Haven, Connecticut on June 7, 1971 are presented. The aircraft crashed short of the runway while on instrument approach to the New Haven airport. An intense fire which occurred immediately after impact was directly responsible for the death of 28 persons aboard the aircraft. Author

N71-32574# RAND Corp., Santa Monica, Calif.
A MODEL FOR EVALUATING VSTOL VERSUS CTOL COMBAT AIRCRAFT SYSTEMS
Seymour Horowitz (FAA) and Robert Shishko Mar. 1971 29 p refs
(P-4587) Avail: NTIS

A cost-effectiveness study of the use of vertical or short takeoff and landing (VSTOL) aircraft for combat missions is described. A comparison is made with conventional (CTOL) aircraft as tactical fighters in a future NATO environment. The conditions under which VSTOL and CTOL aircraft considered as competitive systems are carefully described. A model yielding the probability of completing n successive missions is used as a measure of combat effectiveness. A cost model was constructed to reflect the resource impact of the same variables or alternatives that affect the measure of effectiveness. The integrated format is a necessary condition for the selection of least-cost designs capable of providing a given level of mission performance. A graphical summary of such a format is provided. Author

N71-32589*# Techtran Corp., Glen Burnie, Md.
THE CONTROL SYSTEM OF THE Tu-154 [TU-154: SISTEMA UPRAVLENNYA]
F. Voloshin Washington NASA Aug. 1971 8 p Transl. into ENGLISH from Grazhdanskaya Aviatsiya (USSR), no. 5, 1971 p 18-19
(Contract NASw-2037)
(NASA-TT-F-13789) Avail: NTIS CSCL 01B

Due to a number of design peculiarities of the Tu-154 aircraft, it was necessary to develop a better booster system for controlling rudders and ailerons. A network of three independent hydrobooster systems was designed for the Tu-154 which increase the stability of the aircraft, made piloting easier, and nearly eliminates the danger of complete control system failure. Author

N71-32787*# Rochester Applied Science Associates, Inc., N.Y.
THE EFFECTS OF NONUNIFORM SWASH-PLATE STIFFNESS ON COUPLED BLADE-CONTROL SYSTEM DYNAMICS AND STABILITY. PART 2: COMPUTER PROGRAM LISTING
Vincent J. Pieruili Washington NASA Aug. 1971 71 p
(Contract NAS1-9496)
(NASA-CR-1818; Rept-70-07-Pt-1) Avail: NTIS CSCL 01C

A computer program was developed for investigating the effects of an anisotropically mounted flexible swash-plate, including blade out-of-track, on the vibratory and mechanical stability characteristics of helicopter rotor systems. The analysis which the program implements is based on a combined Laplace transform and associated matrix approach. The analysis and application of the program is presented. The program yields eigenvalues which indicate frequency and rate of growth or decay of a natural mode of the complex system. Blade modal response and swash-plate motion corresponding to a given eigenvalue are predicted. Author

N71-32798*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECTS OF RUNWAY GROOVING ON AIRCRAFT TIRE

SPIN-UP BEHAVIOR
John Locke McCarty Washington Aug. 1971 21 p
(NASA-TM-X-2345; L-7642) Avail: NTIS CSCL 01C

An experimental study was conducted to compare the spin-up behavior of an aircraft tire during touchdown on grooved surfaces with the corresponding behavior on similar ungrooved surfaces. The study involved the impact of 49 × 17, type 7 aircraft tires at several inflation pressures upon dry grooved and ungrooved concrete and asphalt surfaces at ground speeds up to approximately 110 knots. The results indicate that grooving a runway generally reduces wheel spin-up time but does not appreciably affect the maximum wheel spin-up drag loads, at least for the ground speeds of these tests. Tire-tread damage in the form of chevron cutting was observed on the grooved surfaces under some test conditions and appeared to be dependent upon ground speed, tire inflation pressure, and the runway surface material. Author

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N71-31659# Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France). Dept. d'Etudes et de Recherches en Technologie Spatiale.
EFFECTS OF PROTON AND ELECTRON RADIATION ON FRENCH SILICON SOLAR CELLS
J. Bernard, J. P. Buisson, M. Jacquin (Inst. de Phys. Nucl., Lyon), R. Genre (Inst. de Phys. Nucl., Lyon), and J. Pigneret (Inst. de Phys. Nucl., Lyon) Oct. 1970 21 p
(ONERA-NT-02-18-70) Avail: NTIS

The radiation effects on silicon solar cells are analyzed. The electric and photovoltaic properties are studied as a function of two parameters, the energy and integrated fluxes of protons and electrons. The damage coefficients are determined by measurement of the diffusion length of minority carriers, this measurement is obtained by photovoltaic and electrovoltaic methods. In order to study the action of different components, cells without filter, cells with filter, and filters are irradiated. Author (ESRO)

N71-31759# Naval Nuclear Power Unit, Fort Belvoir, Va.
RADIOISOTOPIC POWER GENERATORS OF THE US NAVY, VOLUME 5, NO. 1 Quarterly Operating Report, 1 Jan.–31 Mar. 1971
31 Mar. 1971 77 p refs
(AD-723223) Avail: NTIS CSCL 10/2

The objective of the Report is to serve as a vehicle for the accumulation and dissemination of information concerning the application and operation of radioisotopic power generators (RPGs) within the Navy. It will be noted that all RPGs presently listed are radioisotope thermoelectric generators (RTGs). Unless specifically identified as an engineering evaluation, items contained in this report are presented as an impartial collection of facts, observations, and other information. Two new 25 watt generators were added to the Navy inventory in January and an invitation for bids on four one watt RPGs was issued in mid-March. The LCG-25C1 powered acoustic system and the LCG-25A powered oceanographic data collection system continued to operate normally throughout the reporting period as did the deep ocean transponder network and portable automatic weather station powered by the 1 watt URIPS generators and the Sentinel-8 respectively. Periodic overflights kept the malfunctioning RTG-8/NOMAD Buoy N4E system under surveillance pending a mid-April repair/recovery trip. Author (GRA)

N71-31767# Whiteley Industries, Inc., Wilmington, Mass.
PP6149( )/U POWER UNIT, FUEL CELL Final Report, 1 Aug. 1969–31 Jul. 1970
R. Dumas and R. Salathe Fort Monmouth, N.J. ECOM May 1971 39 p
(Contract DAAB07-70-C-0022)
(AD-723440; ECOM-0022-2) Avail: NTIS CSCL 10/2

This report describes the concept and design plan for a self-contained, portable, 10 ampere, 28 volt D.C. Hydrazine-Air Fuel Cell System by Whiteley Industries, Inc. The design plan proposes a power system consisting of three fuel cell modules, a hydrazine fuel tank, electronic regulation and controls, and appropriate military type packaging case. The complete system comprises a unit having a net energy output density of 3840 watt-hours/cubic foot, and a power density of 320 watts/cubic foot. The delivered energy to weight ratio is 110 watt-hours/pound of system (including fuel charge), and the delivered energy to fuel ratio is 338 watt-hours/pound of fuel. The system is designed such that long-life components as the tankage, regulator, controls, and air source are semi-permanently installed; the three fuel cell modules are designed for minimum cost production and for quick removal and replacement without tools. The unit is designed as a basic power source with protective features and controls to permit charging of a wide range of standard battery configurations. Author (GRA)

N71-31785# AEG-Telefunken, Hamburg (West Germany).
PROJECT HELIOS. PHASE C STUDY: REGULATOR AND CONVERTER [PROJEKT HELIOS. PHASE C-STUDIE: REGLER UND KONVERTER]
H. Hoff, H. Koebel, and H. Schaefer Bad Godesberg, West Ger. Bundesmin. fuer Bildung und Wiss. Apr. 1971 45 p In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Bildung und Wiss.
(BMBW-FB-W-71-17) Avail: NTIS; ZLDI Munich: 9,45 DM

It is demonstrated through experiments that components designed for a power subsystem in connection with previous studies undertaken under the Helios project can be produced on the basis of the present state-of-the-art. Various laboratory models of different types of regulators have been developed and examined. Both the equipment converter and the boost regulator have met requirements. For the two buck-boost regulators, preliminary models, the performance required could not be demonstrated by experiments at the time, but it is achieved by way of further optimization of the circuitry and through the use of more suitable parts. Author (ESRO)

N71-31786# AEG-Telefunken, Hamburg (West Germany). Fachbereich Schiffbau Flugwesen Sondertechnik.
PROJECT HELIOS: INVESTIGATION OF ADHESIVES WITH RESPECT TO HEAT RESISTANCE AND WEIGHT [PROJEKT HELIOS: UNTERSUCHUNG VON KLEBEVERBINDUNGEN AUF TEMPERATURFESTIGKEIT UND GEWICHT]
J. Schneider, D. Scheel, and H. W. Boller Bad Godesberg, West Ger. Bundesmin. fuer Bildung und Wiss. Apr. 1971 35 p In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Bildung und Wiss.
(BMBW-FB-W-71-16) Avail: NTIS; ZLDI Munich: 7,35 DM

After optimization of the glueing procedure, various adhesives used for pasted connections of solar arrays have been exposed to temperature stresses of from −80 to +180 C to test their tensile strength. Other aspects, such as processability and elasticity, have been considered, too. This has led to the statement that the best results are achieved with the adhesive XR-63-489 of Dow Corning. Author (ESRO)

N71-31787# AEG-Telefunken, Hamburg (West Germany). Fachbereich Schiffbau Flugwesen Sondertechnik.
PROJECT HELIOS: INVESTIGATION INTO

TRANSPARENCY OF PASTED CONNECTIONS [PROJEKT HELIOS: UNTERSUCHUNG VON KLEBEVERBINDUNGEN AUF TRANSPARENZ]

J. Schneider, D. Scheel, and H. W. Boller Bad Godesberg, West Ger. Bundesmin. fuer Bildung und Wiss. Apr. 1971 17 p In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Bildung und Wiss.

(BMBW-FB-W-71-15) Avail: NTIS; ZLDI Munich: 3.60 DM

Two cover-glass adhesives have been exposed to temperature stresses of from −80 to +180 C and to UV irradiation to test their spectral transparency. The adhesive RTV602 of General Electric clearly lost part of its transparency after high-temperature stresses, whereas the adhesive XR-63-489 of Dow Corning remained almost unchanged. Author (ESRO)

N71-31939# Clevite Corp., Cleveland, Ohio. Electronic Research Div.

IMPROVEMENTS IN CdS THIN FILM SOLAR CELLS Final Technical Report, 1 Nov. 1969 – 31 Oct. 1970

William F. Dunn Wright-Patterson AFB, Ohio ARL Jan. 1971 82 p refs

(Contract F33615-68-C-1182)

(AD-723315; ARL-71-0015) Avail: NTIS CSCL 10/2

The report is concerned with two areas in the cadmium sulfide thin film solar cell development program: (1) a report on space flight testing of CdS cells and (2) results of a development program for improving the stability and efficiency of the standard CdS cell. Two space flight tests of CdS cells are reported. The first test, ARX-701, contained two CdS panels on the OV1-13 Satellite. The second space flight test contained one CdS panel, ARX-901, and was flown on the OV1-17 Satellite. A development program for obtaining engineering measurements from the CdS cell was carried out. A study was made of heating effects on the cadmium sulfide thin film cell after formation of the barrier layer. Additional investigations were made of low pressure laminations, a silver coated glass powder for metallized substrate use and variations in gridding attachment. Author (GRA)

N71-31947# Argonne National Lab., Ill.

DEVELOPMENT OF HIGH-ENERGY BATTERIES FOR ELECTRIC VEHICLES Progress Report, 1 Feb. 1969 – 30 Jun. 1970

E. J. Cairns, M. L. Kyle, V. A. Maroni, H. Shimotake, and R. K. Steunenberg Jul. 1970 63 p refs Sponsored in part by Natl. Air Pollution Control Admin., Washington, D.C.

(PB-197576) Avail: NTIS CSCL 10C

Experimental investigations were directed toward Li/LiF-LiCl-LiI/Li in S, Li/LiBr-RbBr/Li in S, Li/LiBr-RbBr/Li in P4S10, and Li/LiBr-RbBr/Li in P4S3 cells at temperatures from 325 to 400 C. Small scale (about 1 sq cm electrode area) liquid and paste electrolyte cells were operated to determine conditions under which the cells will deliver current densities of 0.3 to 1 A/sq cm for a large fraction of their capacity densities. Author (GRA)

N71-32048*# Pennsylvania State Univ., University Park. Center for Air Environment Studies.

CYCLED OPERATION OF WATER VAPOR ELECTROLYSIS CELL Annual Report, 1 Jan, – 31 Dec. 1970

A. M. Bloom Mar. 1971 140 p refs

(Grant NGR-39-009-123)

(NASA-CR-119669; CAES-Publ-200-71) Avail: NTIS CSCL 10A

A rigorous mathematical model was developed showing the processes occurring in the electrochemical reactor part of the water vapor electrolysis cell (WVE). The model was then mated with a previously developed model representing heat, mass, and momentum transfer within the feed/product air channel. The result was a rigorous model of the whole WVE cell, which can generate rapid and accurate steady state response to any set of operating conditions. The model is useful not only for predicting cell operation under critical conditions but also for rigor and optimum design of an operating WVE cell. Experimental studies of WVE cell performance under on/off cyclic operation were carried using test cells with two types of electrodes, black platinized tantalum and solid platinum. The power consumption efficiency of the cells was measured to increase by as much as 13 percent due to cyclic operation, relative to steady state operation. With the solid platinum anode, measurements were made such that a minimum cell power consumption was located as a function of both on and off cyclic times. Author

N71-32209*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

DESIGN, FABRICATION, AND PRELIMINARY EVALUATION OF THERMAL AND HYDRAULIC PERFORMANCE OF A PROTOTYPE SNAP-8 MERCURY BOILER

Edward R. Furman and David W. Medwid Washington Aug. 1971 47 p refs

(NASA-TN-D-6451; E-6149) Avail: NTIS CSCL 18N

A prototype SNAP-8, tantalum/stainless-steel, double-containment mercury boiler, designated Serial Number 4, was fabricated at Lewis Research Center and successfully tested in the Power Conversion System loop at the Aerojet Nuclear Systems Company, Azusa, California, for a total of 1620 hours and 26 thermal cycles. This boiler design embodied the same basic tube-bundle configuration as earlier units but included the following significant improvements: the elimination of the expansion bellows by the use of improved tantalum/stainless-steel bimetal joints; full coiling for more compactness; and a more uniform shell-side NaK flow distribution. The thermal-hydraulic performance of this boiler fully met the SNAP-8 system requirements. Author

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N71-31601*# Minnesota Univ., Minneapolis. Div. of Environmental Health.

ENVIRONMENTAL MICROBIOLOGY AS RELATED TO PLANETARY QUARANTINE Semiannual Progress Report, 1 Jun. 1970 – 30 Nov. 1970

Irving J. Pflug Dec. 1970 59 p refs

(Grant NGL-24-005-160)

(NASA-CR-119638; SAPR-5) Avail: NTIS CSCL 06M

The relationship between environmental microbiology and planetary quarantine is discussed. Subjects presented are: (1) survival of microbial spores under several temperature and humidity conditions, (2) detection of low levels of microbial contamination of surfaces by chemical approaches, (3) dry heat destruction rates of microorganisms on surfaces. P.N.F.

N71-31610# School of Aerospace Medicine, Brooks AFB, Tex. Div. of Physiology.

DETERMINATION OF ALPHA-TOCOPHEROL IN FREEZE DRIED FOODS BY A MODIFIED COLORIMETRIC PROCEDURE Final Report, 1 Oct. 1969 – 30 Apr. 1970

Emmett J. Stork and Ramiro P. Villanueva Sep. 1970 11 p refs

(AD-713829; SAM-TR-70-61) Avail: NTIS CSCL 07C

A reliably precise and reproducible determination of

alpha-tocopherol was achieved by an adaptation of the classic colorimetric determination of alpha-tocopherol. The method was preceded by the separation of the various tocopherols either by secondary magnesium phosphate column chromatography or by Florisil column chromatography. The basic method, despite its disadvantages, was considered the most suitable method for use with oils, foods, and feeding stuffs. Samples of precooked, freeze-dried ground beef, chicken cubes, whole eggs, corn, beans, and peas were analyzed and alpha-tocopherol values consistent with those reported in the literature were obtained. Recovery values achieved with the addition of pure alpha-tocopherol ranged from a minimum recovery of 90.2% to a maximum recovery of 99.1%. Author

N71-31613# School of Aerospace Medicine, Brooks AFB, Tex. Otolaryngology Branch.

NOISE WITHIN THE BELL UH-1P HELICOPTER DURING FLIGHT Final Report, Apr.–Jun. 1970

Donald C. Gasaway Sep. 1970 11 p refs

(AD-713830; SAM-TR-70-57) Avail: NTIS CSCL 20A

Measurements are reported for acoustic noise encountered within a Bell UH-1P helicopter during a ground-attack mission. Auditory effects of rocket and gun (7.62 mm minigun) firing are described and illustrated. Factors of aeromedical importance are identified and described. Author

N71-31614# School of Aerospace Medicine, Brook AFB, Tex. Biomedical Engineering Branch.

DETERMINING RESPIRATORY RATE AND VOLUME FROM ECG R-WAVE AMPLITUDE MODULATION Final Report, 1970

Bryan L. Steadman Sep. 1970 11 p refs

(AD-713833; SAM-TR-70-65) Avail: NTIS CSCL 06B

Various ECG electrode placements were investigated to determine which location would yield an R-wave amplitude modulation with the highest possible degree of correlation to respiratory volume. Each subject breathed into a spirometer to generate an electrical signal proportional to instantaneous respiratory volume. This signal was simultaneously recorded with the various electrocardiographic signals sensed by the electrodes attached to the subject. This information was then digitized and a plot of R-wave amplitude versus respiratory volume was made and the coefficient of correlation was computed for each set of data. Author

N71-31733# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

SPONTANEOUS CARDIAC ARRHYTHMIAS INDUCED BY BROMOTRIFLUOROMETHANE

Ethard W. Van Stee and Kenneth C. Back Feb. 1971 19 p refs

(AD-723645; AMRL-TR-68-188) Avail: NTIS CSCL 6/5

Cardiac arrhythmias spontaneously appearing in monkeys exposed to CBrF3 were found to require a minimal blood pressure threshold for their production. The blood pressure threshold varied as an inverse function of the log10 of the CBrF3 concentration to which monkeys in acid-base balance were exposed. Acidosis decreased the threshold and alkalosis increased the threshold at concentrations of 10 and 20 percent CBrF3 but were without effect at 30 percent or greater concentrations. Epinephrine was found to decrease the blood pressure threshold required to trigger arrhythmias but was not necessary for their production as it is in the case of cyclopropane. The difference in individual susceptibility to the spontaneous formation of arrhythmias during exposure to CBrF3 reported by Van Stee and Back (1969) was found to be the result of differences in individual ability to maintain blood pressure during CBrF3 exposure. Author (GRA)

N71-31768# Naval Aerospace Medical Inst., Pensacola, Fla. Research Lab.

EVIDENCE FOR A TEST OF DYNAMIC OTOLITH FUNCTION CONSIDERED IN RELATION TO RESPONSES FROM A PATIENT WITH IDIOPATHIC PROGRESSIVE VESTIBULAR DEGENERATION

Ashton Graybiel, Charles W. Stockwell, and Fred E. Guedry, Jr. 1 Oct. 1970 10 p refs

(AD-722318; NAMRL-1119; NAVMED-MR005.01.01.1208-4) Avail: NTIS CSCL 6/19

A patient is described who possessed residual otolith function, but whose loss of canal function was complete for the horizontal and nearly complete for the vertical canals. A clear (but abnormal) nystagmus response was elicited during rotation about an Earth-horizontal axis, confirming the conclusion, based on animal experiments, that this response depends upon the otolith system. This test appears to measure dynamic otolith function and therefore provides a useful supplement to other vestibular tests. Author (GRA)

N71-32009# Joint Publications Research Service, Washington, D.C.

AUDITORY PATTERN RECOGNITION

N. G. Zagoruyko, ed., et al 15 Jul. 1971 40 p refs Transl. into ENGLISH from the book 'Raspoznavaniye Slukhovykh Obrazov' Novosibirsk, Nauka Press, 11 Feb. 1969

(JPRS-53606) Avail: NTIS

CONTENTS:

1. STRUCTURE OF THE AUDITORY PATTERN RECOGNITION PROBLEM AND METHODS OF SOLVING IT p 1–16 refs (See N71-32010 19-04)

2. METHODS OF VOICE SIGNAL DESCRIPTION AND RECOGNITION p 17–38 refs (See N71-32011 19-04)

N71-32010# Joint Publications Research Service, Washington, D.C.

STRUCTURE OF THE AUDITORY PATTERN RECOGNITION PROBLEM AND METHODS OF SOLVING IT

In its Auditory Pattern Recognition 15 Jul. 1971 p 1–16 refs (See N71-32009 19-04)

Avail: NTIS

The problems and methods to solve automatic auditory pattern recognition are discussed. An extensive bibliography is included. E.H.W.

N71-32011# Joint Publications Research Service, Washington, D.C.

METHODS OF VOICE SIGNAL DESCRIPTION AND RECOGNITION

In its Auditory Pattern Recognition 15 Jul. 1971 p 17–38 refs (See N71-32009 19-04)

Avail: NTIS

The use of analog to digital converters in voice signal analysis to reduce cost and search operation time is discussed. The requirements imposed on the input devices and the parameters of existing converters are given. An extensive bibliography is included. E.H.W.

N71-32012# Joint Publications Research Service, Washington, D.C.

VISUAL, MEMORY AND BIONIC MODELS' ROLE ANALYZED

21 Jul. 1971 34 p refs Transl. into ENGLISH from Probl. Bioniki, Resp. Mezhduved. Nauchn.-Tekhn. Sb. (Kharkov), no. 2, 1970 p 31–32 and 68–87

(JPRS-53647) Avail: NTIS

CONTENTS:

1. CERTAIN GENERALIZATIONS IN A MATHEMATICAL MODEL OF VISION G. S. Grushko p 1–3 ref (See N71-32013 19-04)

2. REGISTERING STRUCTURE AS A MEMORY MODEL AND ITS ROLE IN PERCEPTION PROCESSES E. V. Uteush p 4–23 refs (See N71-32014 19-04)

3. CONCERNING A PROMISING TREND IN COMPUTER TECHNOLOGY V. P. Belyavskiy et al p 24–32 refs (See N71-32015 19-08)

N71-32013# Joint Publications Research Service, Washington, D.C.

CERTAIN GENERALIZATIONS IN A MATHEMATICAL MODEL OF VISION

G. S. Grushko *In its* Visual, Memory and Bionic Models' Role Analyzed 21 Jul. 1971 p 1–3 ref (See N71-32012 19-04) Avail: NTIS

Mathematical models are presented to describe the vision process. Numerical relationships of brilliance of the optical pattern, brilliance of visual sensation, coefficient of visual inertia, and coefficient of sighting irradiation are established. P.N.F.

N71-32014# Joint Publications Research Service, Washington, D.C.

REGISTERING STRUCTURE AS A MEMORY MODEL AND ITS ROLE IN PRECEPTION PROCESSES

E. V. Uteush *In its* Visual, Memory and Bionic Models' Role Analyzed 21 Jul. 1971 p 4–23 refs (See N71-32012 19-04) Avail: NTIS

The problem of the structure of memory is discussed. The processes of information storage in the memory and the control over the recording of information are examined. Hydraulic and electric analogies are established and numerical models of the memory process are presented. P.N.F.

N71-32032# Joint Publications Research Service, Washington, D.C.

NEURON SIMULATION AND SCANNING SYSTEMS OUTLINED

14 Jul. 1971 20 p refs Transl. into ENGLISH from Sovrem. Probl. Kibernetiki (Moscow), 262–267, 376–382 (JPRS-53597) Avail: NTIS

CONTENTS:

1. MODELLING THE ADAPTATION OF A NEURON AND SPONTANEOUS ACTIVITY OF NEURON NET A. S. Kolokolov et al p 1–8 refs (See N71-32033 19-04)

2. ON A SYNTHESIS OF SEARCH TYPE SCANNING SYSTEMS S. Y. Zdor p 9–18 refs (See N71-32034 19-04)

N71-32033# Joint Publications Research Service, Washington, D.C.

MODELLING THE ADAPTATION OF A NEURON AND SPONTANEOUS ACTIVITY OF NEURON NET

A. S. Kolokolov et al *In its* Neuron Simulation and Scanning Systems Outlined 14 Jul. 1971 p 1–8 refs (See N71-32032 19-04) Avail: NTIS

Methods of constructing a neuron adaptation model and simulating the spontaneous activity of a neuron network are described. Neuron adaptation involves a reduction in the frequency time of pulses being generated, a concept applicable to a biological neuron which cannot be held in an indefinite excited state due to limited internal energy resources. As an elementary cell of a nerve network, use is made of an analog model containing a blocking generator with controllable frequency. Simulation of the neuron adaptation is then discussed, as well as development of a simple neuron multivibrator. Finally, expansion of this multivibrator into a switching neuron network with a controlled rate of transmitting the excitation is treated. A.C.R.

N71-32034# Joint Publications Research Service, Washington, D.C.

ON A SYNTHESIS OF SEARCH TYPE SCANNING SYSTEMS

S. Ye. Zdor *In its* Neuron Simulation and Scanning Systems Outlined 14 Jul. 1970 p 9–18 refs (See N71-32032 19-04) Avail: NTIS

Synthesis of search scanning systems is discussed, emphasizing the primary variables that must be considered in formulating optimal distribution of search efforts. It appears that optimal scanning efficiency is directly related to a special filament optical image converter. A mathematical procedure for developing the basic specifications for such a converter is described. A.C.R.

N71-32079# Federal Aviation Administration, Oklahoma City, Okla. Civil Aeromedical Inst.

ALCOHOL AND DISORIENTATION RELATED RESPONSES. 1: NYSTAGMUS AND VERTIGO DURING CALORIC AND OPTOKINETIC STIMULATION

David J. Schroeder Feb. 1971 30 p refs (FAA-AM-71-6) Avail: NTIS

The effects of two levels of alcohol on the vertigo and nystagmic responses resulting from caloric irrigations with visual conditions and the alertness of the subjects carefully controlled are reported. Additional information concerning the effects of alcohol on optokinetic nystagmus was also obtained. The data clearly indicate that alcohol suppresses the nystagmic response to calorizations in total darkness. However, under conditions where visual fixation is permitted and where visual fixation would normally inhibit caloric vestibular responses, the ingestion of alcohol results in a high-frequency, low-amplitude nystagmus. This response, however, is not due to increased vestibular sensitivity, but rather to the suppression, by alcohol (directly or indirectly), of the visual fixation system. This visual inhibition was also evident in the suppression of the optokinetic response by alcohol. Vertigo responses to caloric irrigations showed only slight suppression or some enhancement in darkness following alcohol ingestion; however, blurring of vision was prominent when visual fixation was permitted. Author

N71-32081# Oklahoma Univ., Oklahoma City. Dept. of Physiology and Biophysics.

EFFECT OF A MOVING OPTICAL ENVIRONMENT ON THE SUBJECTIVE MEDIAN

M. Herbert Brecher and Gerhard A. Brecher Apr. 1971 3 p refs (Contract FA-67-AC-2899-1) (FAA-AM-71-22) Avail: NTIS

The placement of a point in the median vertical plane under the influence of a moving optical environment was tested in 12 subjects. It was found that the median plane was displaced in the same direction as the movement of the visual environment when the environment was moved at speeds ranging from 9 plus or minus radians/minute to 45 plus or minus 1 radians/minute. It was established that unidirectional movements of the total optical environment always caused a spatial disorientation with respect to external visual reference points. Author

N71-32082# Federal Aviation Administration, Oklahoma City, Okla. Civil Aeromedical Inst.

PHYSIOLOGICAL RESPONSES OF LOW TIME PRIVATE PILOTS TO CROSS-COUNTRY FLYING

C. E. Melton and Vincent Fiorica Apr. 1971 8 p refs (FAA-AM-71-23) Avail: NTIS

Various physiological, biochemical, and psychophysiological measurements were made on low-time private pilots who each flew three cross-country flights. The round-trip flights were 320, 520, and 960 NM in length. Heart rate was recorded continuously throughout the flights. Urine, collected for the 24-hour-period surrounding the flights, was differentially analyzed for epinephrine and norepinephrine. None of the measured parameters changed in proportion to the length of the flights; however, the level of stress was high when compared to other types of flying activities. The total stress of such flights must, therefore, be considered to be in direct proportion to the length of the flights. Author

N71-32083# Federal Aviation Administration, Washington, D.C. Office of Aviation Medicine.

CIVIL AEROMEDICAL STANDARDS FOR GENERAL USE AEROSPACE TRANSPORTATION VEHICLES: THE SPACE SHUTTLE FOLLOW-ON

Stanley R. Mohler and Siegfried J. Gerathewohl Jul. 1971 7 p refs

(FAA-AM-71-33) Avail: NTIS

Second-generation general-use aerospace transportation vehicles will evolve, and aerospace medical specialists must provide timely medical criteria for (a) occupant selection, (b) vehicle design features, and (c) operational guidelines. Incorporation of this aeromedical data will result in (a) enhanced mission success and mission efficiency, and (b) minimized opportunity for mission failure, accidents, and long-range adverse consequences due to human factors deficiencies. The data include medical standards for the occupants plus standards for oxygen, nitrogen, carbon dioxide and monoxide, humidity, heat, water vapor, internal noise, radiation, and other items. Author

N71-32088# Joint Publications Research Service, Washington, D.C.

CYBERNETICS AND REGULATION THEORY

6 Jul. 1971 21 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 197, no. 6, 1971 p 1280–1290 (JPRS-53531) Avail: NTIS

CONTENTS:

1. BEHAVIORAL SELECTION EXPERIMENTS CITED N. I. Glazunov et al p 1–7 refs (See N71-32089 19-04)
2. EFFECTS OF VIBRATION ON HUMANS INVESTIGATED B. A. Potemkin et al p 8–14 refs (See N71-32090 19-04)
3. STOCHASTIC SYSTEM COMBINATIONS DISCUSSED V. S. Pugachev p 15–19 (See N71-32091 19-19)

N71-32089# Joint Publications Research Service, Washington, D.C.

BEHAVIORAL SELECTION EXPERIMENTS CITED

N. I. Glazunov et al *In its* Cybernetics and Regulation Theory 6 Jul. 1971 p 1–7 refs (See N71-32088 19-04) Avail: NTIS

A model is constructed to quantitatively examine the performance of automatic machines with normal and disturbed behavior (in the sense of function). In making statistical decisions these characteristics are compared with the behavior of healthy and sick people. The proposed model can be utilized in the diagnostic practice of psychiatric clinics or in engineering psychology. E.M.C.

N71-32090# Joint Publications Research Service, Washington, D.C.

EFFECTS OF VIBRATION ON HUMANS INVESTIGATED

B. A. Potemkin et al *In its* Cybernetics and Regulation Theory 6 Jul. 1971 p 8–14 refs (See N71-32088 19-04) Avail: NTIS

Dynamic reactions of an operator with random vibrational stimuli is treated in relation to biomechanical systems. Transmitting functions of the model were determined from fundamental correlation of statistical dynamics of linear systems. Also, mechanical models were formulated to evaluate frequency characteristics of the human body for various postures. An expression was derived for a chain system model with functions corresponding to impedances of parallel branches and to the dynamic mobility of branches that are in sequence. E.M.C.

N71-32231*# George Washington Univ., Washington, D.C. Medical Center.

SCIENTIFIC PUBLICATIONS AND PRESENTATIONS RELATING TO PLANETARY QUARANTINE. VOLUME 5: THE 1970 SUPPLEMENT

Frank D. Bradley and Margaret F. Werts Aug. 1971 121 p refs

(Contract NSR-09-010-027)

(NASA-CR-121325) Avail: NTIS CSCL 06M

The fourth annual supplement to the original bibliography issued in June, 1967, entitled Scientific Publications of the Biosciences Programs Division, National Aeronautics and Space Administration, Volume V. Planetary Quarantine, is presented. The annual supplements consist of citations of documents relating to planetary quarantine. While they are compiled primarily to bring up to date the survey of the literature in the field, it will be noted that there is also a heavy back gathering of references not previously included. Some of these ante-date the formation of NASA, but are of substantive or historical value to the planetary quarantine program. Author

N71-32232*# Scientific Translation Service, Santa Barbara, Calif.

USING THE METHOD OF SEPARATION AND IDENTIFICATION OF AMINO ACIDS TO DETECT EXTRATERRESTRIAL LIFE [ISPOLZOVANIYE METODA VYDELENIYA I IDENTIFIKATSII AMINOKISLOT DLYA OBNARUZHENIYA ZHIZNI VNE ZEMLI]

G. A. Lavrentyev Washington NASA Aug. 1971 13 p refs Transl. into ENGLISH of Acad. of Sci. (USSR), Moscow, Inst. for Space Res. report Pr-59

(Contract NASw-2035)

(NASA-TT-F-13765) Avail: NTIS CSCL 06F

A method is developed for separating amino acids from soils on the Earth and for analyzing them. The development of an automatic system which would allow amino acids in soil samples from other planets, to be analyzed by automatic space stations, is proposed. Author

N71-32239# Defense Documentation Center, Alexandria, Va.

RADIATION INJURIES AND SICKNESS: A DDC BIBLIOGRAPHY, VOLUME 1, MAY 1957–JULY 1970

May 1971 237 p refs

(AD-722970; DDC-TAS-71-14-1-Vol-1) Avail: NTIS CSCL 6/18

The annotated references were compiled from the Defense Documentation Center's data bank on injuries and sicknesses caused by radiation and radioactive decays. Indexes of corporate author-monitoring agency, subject, and title are provided in this bibliography. Author (GRA)

N71-32433# Federal Aviation Administration, Oklahoma City, Okla. Civil Aeromedical Inst.

ALCOHOL AND DISORIENTATION-RELATED REPONSES. 3: EFFECTS OF ALCOHOL INGESTION ON TRACKING PERFORMANCE DURING ANGULAR ACCELERATION

William E. Collins, Richard D. Gilson (Naval Aerospace Medical Inst.), David J. Schroeder, and Frederick E. Guedry, Jr. (Naval

Aerospace Medical Inst.) Apr. 1971 20 p refs
(FAA-AM-71-20) Avail: NTIS

The effects of alcohol ingestion on visual tracking performance (eye-hand coordination) during angular acceleration are considered. Following practice and base-line tests of tracking performance in both static and dynamic conditions, 10 subjects received orange juice which contained 2.0 ml of 100-proof vodka per kg of subject weight; another 10 drank orange juice with a few drops of rum extract added. Tests, conducted 1, 2, 4, 8, and 10 hours after drinking, were in total darkness with the exception of the visual display which was illuminated to recommended levels for cockpit instruments. Static tracking errors for alcohol subjects were significantly higher than those of control subjects only at the 4-hour session. However, alcohol subjects made significantly more dynamic tracking errors than controls during the 1-, 2-, and 4-hour sessions. These data suggest that eye-hand coordination may show little or no impairment following alcohol ingestion in static situations, yet may be seriously degraded during motion. Author

N71-32434# Federal Aviation Administration, Oklahoma City, Okla. Civil Aeromedical Inst.
A NON-VERBAL TECHNIQUE FOR THE ASSESSMENT OF GENERAL INTELLECTUAL ABILITY IN SELECTION OF AVIATION PERSONNEL
W. Dean Chiles and Roger C. Smith Jun. 1971 12 p refs
(FAA-AM-71-28) Avail: NTIS

A study was conducted in which performance on a non-verbal problem solving task was correlated with the Otis Quick-Scoring Mental Ability Test and the Raven Progressive Matrices Test. The problem solving task, called code-lock, required the subject to determine the correct sequence in which to push five buttons in order to turn on a light. Measures of how quickly the subject responded and how many errors were made on each problem were taken from 45 college student volunteers. Results indicated substantial correlations (.50 to .60) between time measures on the code-lock task and the Otis but very limited relationships between the Raven and each code-lock measure. The implications of these findings for assessment of intellectual abilities are discussed. Author

N71-32474*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A MODEL FOR MEMORY IN THE BRAIN
James S. Albus Washington Aug. 1971 16 p refs
(NASA-TN-D-6456; G-953) Avail: NTIS CSCL 06B

Among the many different types of memory models, the oldest and most persistent hypothesis has been that memory results from modification of synaptic junctions. The proposed model is a synaptic junction model which differs only slightly from other synaptic junction models, but the difference is critical. This model, like most others, suggests that facilitation of synapses is caused by coincidence of pre- and post-synaptic activity. But, unlike others, this model distinguishes between synapses in nonspecific and specific neural pathways and postulates that facilitatable memory synapses exist primarily at sites where nonspecific fibers terminate on specific pathways. Author

N71-32520*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif. Advanced Biotechnology and Power Dept.
COMPOSITION AND CONCENTRATIVE PROPERTIES OF HUMAN URINE
David F. Putnam Washington NASA Jul. 1971 110 p refs
(Contract NAS1-8954)
(NASA-CR-1902; DAC-61125-F) Avail: NTIS CSCL 06P

The composition of typical human urine is defined and experimental data is presented on its chemical, physical, engineering and concentrative properties. The effects of chemical and electrolytic pretreatments used in aerospace applications for extraction of potable water are included. The results are presented in tables and plots of unsmoothed data, empirical equations, and tables of nominal values. Sample calculations and examples illustrating the consideration of these data in engineering design applications are included. Author

N71-32547 West Virginia Univ., Morgantown.
MECHANICAL PROPERTIES OF THE HEAD
Richard Lynn Stalnaker (Ph.D. Thesis) 1969 130 p
Avail: Univ. Microfilms Order No. 70-15266

Research was conducted to provide basic information concerning the mechanical responses of the head. The instrumentation and experimental techniques will be used in a survey of materials to be used in the construction of an artificial head. An electromagnic shaker and a spectral dynamics analyzer were used to determine the mechanical impedance of the live Macaca mulatta monkey head, live monkey head with high blood pressure, dead monkey with low blood pressure, dead monkey head with body removed, the dead monkey skull with the brain, and the dead monkey skull. A microminiature accelerometer and pressure transducers were developed for implantation into the brain. This transducer was implanted in three of the five monkeys tested. The acceleration on the side of the head opposite the point of application of the load for driving point impedance was recorded. Dissert. Abstr.

N71-32568# School of Aerospace Medicine, Brooks AFB, Tex.
INFORMATION MODEL DISPLAYING THE PROCESS INVOLVED IN PILOTING AIRCRAFT [OB INFORMATSIONNOY MODELIDLYA OTOBRAZHENIYA PROTESSA PILOTIROVANIYA SAMOLETA LETCHIKOM]
L. I. Vinograi 1971 13 p refs Transl. into ENGLISH from Vopr. Psikhologii (Moscow), v. 13, no. 4, 1967 p 153FF
(AD-723051; SAM-TT-R-1039-0571) Avail: NTIS CSCL 5/10

An information model is proposed which may be used under laboratory conditions for research or as a display device on the ground as part of the radiotelemetry system used to transmit the parameters of the aircraft to the flight operations command post. The availability to the flight operations officer of information on the behavior curve of the pilot-aircraft system during the actual flight process makes control more effective and visible. He will be able not only to evaluate piloting quality, but also to send corrective commands to the pilot in the event of significant deviations in the motion parameters from the expected ones, or in the case of an emergency situation. When remote control is used, an additional control and handling team is formed parallel to the pilot-aircraft control team. It consists of the flight operations officer, the radio control and the telemetry equipment. In this case, the flight operations officer becomes an active operator in the complex system of flight control and guidance. Author (GRA)

N71-32572# Stanford Research Inst., Menlo Park, Calif.
A STUDY OF SENSITIVITY TO NOISE Final Report
R. W. Becker, F. Poza, and K. D. Kryter Jun. 1971 64 p refs
(Contract DOT-FA69WA-2211)
(EQ-71-4) Avail: NTIS

About 140 subjects were exposed to simulated sonic booms and recorded residential noises in one, two, or three two-hour sessions over a period of six months. Electrophysiological measures of heart rate and electromyographic responses to the stimuli were analyzed. Biographical, demographical, and personality inventories were also obtained for each of the subjects. The purpose of this research was to: (1) determine whether there are different degrees of psychological and physiological sensitivity to noise in a large group of people, (2) to determine whether and how such sensitivity varied in time, and (3) to relate such sensitivity to other psychological and personality variables. Significant differences in psychological sensitivity to noise were found in the subject population. These differences remained stable for the duration of the

experiment and were also found to be related to the attitudinal and belief structures of the individuals. Definite physiological responses to the simulated sonic booms were observed. Author

N71-32602# Astro Nautical Research, Inc., Cambridge, Mass.
REPETITIVE EXCURSION DIVES FROM SATURATED DEPTHS ON HELIUM-OXYGEN MIXTURES. PHASE 3: SATURATION DEPTH 300 FEET
James K. Summitt, John M. Alexander, Edward T. Flynn, and J. Wayne Kulig Washington Navy Exptl. Diving Unit 23 Sep. 1970 27 p refs
(Contract N00024-70-C-5559)
(AD-723172; NEDU-RR-7-70) Avail: NTIS CSCL 6/19

Three 300-foot He02 saturation dives were conducted at the Navy Experimental Diving Unit to verify a no-decompression repetitive excursion format developed by the Deep Submergence Systems Project (PM-11). The table for this series of dives is the same as the one previously tested and found to be satisfactory for repetitive-excursion dives from a saturation depth of 350 feet. Twelve divers completed a total of 216 man-excursion dives from the saturation depth to depths not exceeding 150 feet deeper than their base depth. No symptoms of decompression sickness were reported during the excursion dives, during the bottom time at 300 feet or throughout the decompression on returning to the surface. Author (GRA)

N71-32632# Astro Nautical Research, Inc., Cambridge, Mass.
REPETITIVE EXCURSION DIVES FROM SATURATED DEPTHS ON HELIUM-OXYGEN MIXTURES. PHASE 4: SATURATION DEPTH 500 FEET, SATURATION DEPTH 600 FEET
James K. Summitt, John M. Alexander, Edward T. Flynn, and J. Wayne Kuling 23 Sep. 1970 41 p refs
(Contract N00024-70-C-5559)
(AD-723173; NEDU-RR-8-70) Avail: NTIS CSCL 6/19

One 500-foot and two 600-foot saturation dives were conducted at the Navy Experimental Diving Unit to verify a no-decompression repetitive-excursion format developed by the Deep Submergence Systems Project (PM-11). This is the same table previously tested and found to be satisfactory for repetitive-excursion dives from saturation depths of 350 feet and 300 feet. Twelve divers completed a total of 206 man-excursion dives from the respective saturation depths to depths not exceeding 150 feet deeper than their base depth. No symptoms of decompression sickness were reported during the bottom time at 500 feet and 600 feet or during the first 200 feet of decompression back to the surface. This criteria is considered to be satisfactory evidence of the safety of the repetitive-excursion format. Three cases of decompression sickness did occur during the latter stages of decompression, and they are briefly discussed. Author (GRA)

N71-32716# Aerospace Medical Research Lab., Wright-Patterson AFB, Ohio.
A COLLATION OF ANTHROPOMETRY. VOLUME 2: I-Z AND INDEX
John W. Garrett and Kenneth W. Kennedy Mar. 1971 1081 p refs
(AD-723630; AMRL-TR-68-1-Vol-2) Avail: NTIS HC (Individually priced)/MF $0.95 CSCL 6/16

The document is volume 2 of a two-volume collation of adult anthropometry, the sources for which are both domestic and foreign, male and female, military and civilian. GRA

N71-32770# Astro Nautical Research, Inc., Cambridge, Mass.
REPETITIVE EXCURSION DIVES FROM SATURATED DEPTHS ON HELIUM-OXYGEN MIXTURES. PHASE 2: SATURATION DEPTH 200 FEET, SATURATION DEPTH 150 FEET
James K. Summitt, Jerry M. Herron, John M. Alexander, J. Wayne Kulig, and Edward T. Flynn 23 Sep 1971 53 p refs
(Contract N00024-70-C-5559)
(AD-723171; NEDU-RR-6-70) Avail: NTIS CSCL 6/19

Two 200-foot and three 150-foot saturation dives were conducted at the US Navy Experimental Diving Unit to verify a no-decompression repetitive-excursion format developed by the Deep Submergence Systems Project (PM-11). Twenty divers completed a total of 360 man-excursion dives from the saturation depths to depths not exceeding 100 feet deeper than their base depth. No symptoms of decompression sickness were reported during the excursion dives, during the bottom time at 200 and 150 feet or during the first 24 hours of decompression back to the surface. This criteria is considered to be satisfactory evidence of the safety of the repetitive-excursion format. Four cases of decompression sickness occurred during decompression to the surface. One case of decompression sickness occurred 8 hours and 21 minutes after surfacing. All five cases are briefly discussed. Author (GRA)

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N71-31608*# Welson (B.) and Co., Inc., Hartford, Conn.
DEVELOPMENT OF LUNAR SAMPLE PROCESSING GLOVES FOR THE LUNAR RECEIVING LABORATORY Final Report
24 Jun. 1971 55 p
(Contract NAS9-11626)
(NASA-CR-115112) Avail: NTIS CSCL 06Q

The feasibility was established of developing a pair of all viton gloves for use in the sterile nitrogen atmospheric processing cabinet of the Lunar Receiving Laboratory. All aspects, from material formulation to finished product packaging, are documented together with discussions of in-house experimentation activities. Author

N71-31612# School of Aerospace Medicine, Brooks AFB, Tex. Biometrics Div.
AUTOMATIC DETECTION AND DISPLAY OF ARRHYTHMIAS ON A DESK-TOP ANALOG COMPUTER Final Report, Oct. 1968 – Oct. 1969
Edward J. Engelken Jun. 1970 8 p refs
(AD-711039; SAM-TR-70-34) Avail: NTIS CSCL 06B

A previously discussed technic for the automatic detection and display of arrhythmias was improved and programmed on an EAI TR-20 desk-top analog computer. A complete program description, diagram, and parts list is provided to enable the duplication of the program with minimum effort. Author

N71-31616# Naval Aerospace Medical Inst., Pensacola, Fla. Bureau of Medicine and Surgery.
LIVING HUMAN DYNAMIC RESPONSE TO – G SUB x IMPACT ACCELERATION. 2: ACCELERATIONS MEASURED ON THE HEAD AND NECK
C. L. Ewing, D. J. Thomas (Harvard School of Public Health), L. M. Patrick (Wayne State Univ.), G. W. Beeler (Mayo Clinic), and M. J. Smith Repr. from 13th Stapp Car Crash Conf., 1969 Oct. 1970 18 p refs Prepared in cooperation with the Army Aeromedical Research Lab., Fort Rucker, Ala.
(AD-717130; NAMRL-1122; USAARL-71-11) Avail: NTIS CSCL 06S

A methodical investigation and measurement of human dynamic response to impact acceleration is presented. Linear

accelerations are being measured on the top of the head, at the mouth, and at the base of the neck. Angular velocity is also being measured at the base of the neck and at the mouth. A redundant photographic system is being used for validation. All data are collected in computer compatible format and data processing is by digital computer. Selected data in a stage of interim analysis on 18 representative human runs of the 236 humans runs completed to date are presented. Review of the data indicates that peak accelerations measured at the mouth are higher than previous estimates. The time relationship of the peak resultant mouth accelerations to the peak sled acceleration for this particular accelerator and restraint system is described. The maximum peak resultant mouth acceleration was 47.8 g and the peak mouth angular velocity on another run exceeded 30 rad/sec, on nominal 10 g, 250 g/sec runs. Clinical evaluation of the subjects before and after the runs disclosed no evidence of unconsciousness or neurological deficit attributable to the acceleration. Author

N71-31617# Aberdeen Research and Development Center, Aberdeen Proving Ground, Md. Human Engineering Labs.
MILESTONES: A DIRECTORY OF HUMAN ENGINEERING LABORATORIES PUBLICATIONS, 1953 – 1970
Jan. 1971 128 p
Avail: NTIS

An updated directory of MILESTONES is presented which provides information on research conducted in Human Engineering Laboratories. Subject categories include aircraft, audition, environment, information processing, vehicles, vision, weapons, and related subjects. E.M.C.

N71-31618*# Naval Aerospace Medical Inst., Pensacola, Fla.
LIGHTING FACTORS AFFECTING THE VISIBILITY OF A MOVING DISPLAY
Richard D. Gilson and Robert H. Elliott 7 Aug. 1970 12 p refs Prepared in cooperation with the Army Aeromedical Res. Lab., Fort Rucker, Ala.
(NASA Order L-43518)
(NASA-CR-119640; AD-715625; NAMRL-1113; USAARL-71-4) Avail: NTIS CSCL 05E

Compensatory tracking performance was shown to be substantially degraded by oscillation of the visual display at both 1.0 Hz and 2.0 Hz. The severity of this decrement was significantly altered by changes in both the color and the intensity of the display illumination. Performance was significantly better with red light illuminating the display at 0.05 mL than with blue light at the equivalent luminance. This improvement in performance was similar in magnitude to that found for an increase in broadband illumination of the display where luminance was increased from one-half log unit below to one-half log unit above 0.05 mL. Visual mechanisms that may have been responsible for these findings are suggested and practical considerations of instrument lighting are discussed. Author

N71-31620# Naval Aerospace Medical Inst., Pensacola, Fla. Bureau of Medicine and Surgery.
THE APPLICATION OF COLLEGE AND FLIGHT BACKGROUND QUESTIONNAIRES AS SUPPLEMENTARY NONCOGNITIVE MEASURES FOR USE IN THE SELECTION OF STUDENT NAVAL AVIATORS
Ronald M. Bale and Rosalie K. Ambler 6 Oct. 1970 16 p refs
(AD-717941; NAMRL-1120) Avail: NTIS CSCL 05I

A multiple correlation approach was utilized to demonstrate that the inclusion of noncognitive college and flight background information would enhace the sensivity of selection processes, thus reducing the attrition rate of student naval aviators. The initial results confirmed the hypothesis and the findings were upheld by crossvalidation. Implementation of the suggested technique would have reduced the attrition rate by 4.5 percentage points for the cross-validation sample. It is recommended that the technique be incorporated as a management tool at the primary selection level. Author

N71-31621# Naval Aerospace Medical Inst., Pensacola, Fla. Bureau of Medicine and Surgery.
REPLACEMENT AIR GROUP PERFORMANCE AS A CRITERION FOR NAVAL AVIATION TRAINING
Ronald M. Bale, George M. Rickus, Jr. and Rosalie K. Ambler 8 Dec. 1970 11 p refs
(AD-718848; NAMRL-1126) Avail: NTIS CSCL 05I

A multiple correlation analysis was used to examine the possibility of utilizing replacement air group completion as an advanced criterion variable for student naval aviator performance prediction and probability estimation of student completion of flight training. Undergraduate training grades were found to significantly predict replacement air group completion. The findings were crossvalidated on an equivalent sample. Had the proposed weighting system been employed, the attrition rate of the cross-validation sample would have been reduced by 33.8 percent. Author

N71-31622# School of Aerospace Medicine, Brooks AFB, Tex. Biomedical Engineering Branch.
ELECTROCARDIOGRAM R-WAVE AMPLITUDE DETECTOR Technical Report, Oct. 1968 – Apr. 1970
Bryan L. Steadman Sep. 1970 11 p
(AD-712668; SAM-TR-70-60) Avail: NTIS CSCL 06B

A device is described that accepts a raw electrocardiographic signal as an input and generates a steplike output where the height of each step represents the amplitude of each R-wave on a beat-by-beat basis. The instrument is designed to accept an input peak-to-peak signal of 0.5 mV to 5.0 V, enabling it to accept most of the commonly available signal levels. An adjustable dc offset and optional ac coupling circuit are available in the output stage of the device to facilitate the study of the beat-by-beat change in R-wave amplitude. Author

N71-31625# Human Resources Research Organization, Alexandria, Va. Div. No. 5.
AIRCRAFT RECOGNITION PERFORMANCE OF CREW CHIEFS WITH AND WITHOUT FORWARD OBSERVERS
Robert D. Baldwin, Edward W. Frederickson, and Edward C. Hackerson Aug. 1970 43 p refs
(Contract DAHC19-70-C-0012)
(AD-714213; HumRRO-TR-70-12) Avail: NTIS CSCL 05I

A test of aircraft recognition accuracy and decision speed compared the performance of single observers and four man crews. The test used miniaturized simulations of aircraft which were moved at scaled speeds, altitudes, and distances. The validity of the simulation was evaluated, and judged acceptable, by comapring the results of the miniaturized test with results obtained from a previous full-scale test. Comparison of single observers with crews revealed that approximately 50 percent of the observers performed more effectively when alone that when with a crew, in terms of both accuracy and decision speed. The remaining observers performed either equally well, or more effectively when with a crew than when alone. These two groups of effective crew observers tended to be less dependent upon other crewmen judgments than the less effective crew observers. E.M.C.

N71-31660# Southampton Univ. (England). Inst. of Sound and Vibration Research.
PILOT VISUAL ACUITY DURING HELICOPTER FLIGHT
M. J. Griffin Feb. 1971 43 p refs Sponsored by Min. of Defence
(ISVR-TR-44) Avail: NTIS

An experiment to determine pilot visual acuity during helicopter flight is described. The visual task consisted of detecting black wire-shaped objects against uniformly illuminated backgrounds. Experimented results indicate that there is an acuity decrement when viewing the test objects under certain conditions during helicopter flight. Acuity during flight was significantly worse than when standing on the ground for black visual test objects presented against a dark grey background. There was no significant difference between the two scores when the same black test objects were presented against a white background. The implications of these results are discussed and recommendations for further work are presented. Author (ESRO)

N71-31741# Air Force Human Resources Lab., Williams AFB, Ariz. Flying Training Div.
IMPROVED CREW MEMBER TRAINING THROUGH A NEW PHILOSOPHY TOWARD TRAINING
Milton E. Wood Aug. 1970 12 p refs
(AD-723313; AFHRL-TR-70-31) Avail: NTIS CSCL 5/9

New emphasis on the total learning process is bringing about significant changes in both the educational and training communities. The process-oriented, systems approach to training integrates behavioral objectives, media, and instructors in such a way that increased training effectiveness is realized through a greater ability to deal with the learning requirements of the individual student. Based on current United States Air Force efforts to employ and evaluate this general approach to training, new efficiencies in instruction are indicated. This system will provide a basis for defining the characteristics of future UPT multi-media systems. The basic principles inherent in the new-look in training appears to be generally applicable to all phases of crew-member training. Author (GRA)

N71-31888# Vereinigte Flugtechnische Werke-Fokker G.m.b.H., Bremen (West Germany).
ON THE QUESTION OF PILOT INJURY DURING LOW ALTITUDE FLIGHT [ZU FRAGEN DER PILOTENSCHAEDIGUNG BEIM TIEFFLUG]
P. Schulz *In* DGLR Turbulence Model at Low Altitudes and Flight in a Turbulent Atmosphere Dec. 1970 p 99–117 refs In GERMAN (See N71-31882 19-02)
Avail: NTIS; ZLDI Munich: 34 DM

The calculation of pilot injuries during low altitude high speed flight is presented. The pilot acceleration loads due to gusts and low level turbulence are calculated for stochastic disturbances, and the transfer function of the aircraft is taken into account. ESRO

N71-31942# Naval Aerospace Medical Inst., Pensacola, Fla.
SELECTED BIVARIATE ANTHROPOMETRIC DISTRIBUTIONS DESCRIBING A SAMPLE OF NAVAL AVIATORS, 1964
William F. Moroney 10 Mar. 1971 39 p refs
(AD-723796; NAMRL-1130; NAVMED-MF12.524.002-5013D) Avail: NTIS CSCL 5/5

Previous anthropometric surveys presented means, standard deviations, ranges, and percentiles as descriptors of the anthropometric features of aviator populations. These reports were limited to a consideration of each variable independently. However, designers also need knowledge of the interaction between variables in order to determine what proportion of the potential operator population their design decisions will eliminate. This report extends data previously collected from 1549 naval aviation personnel by presenting bivariate tables that illustrate the relationship between selected variables. Twenty-one tables were prepared which contained selected interactions between the following variables: bideltoid diameter; buttock-knee length; eye height, sitting; functional reach; head height; knee height, sitting; sitting height; shoulder height, sitting; standing height; and thigh circumference. Means, standard deviations, ranges, regression equations, standard error of estimate, and percentile levels were also presented for each variable. Author (GRA)

N71-32331# Texas Technological Univ., Lubbock. Center of Biotechnology and Human Performance.
PERFORMANCE, RECOVERY AND MAN-MACHINE EFFECTIVENESS Semiannual Progress Report, 1 Sep. 1970–28 Feb. 1971
Richard A. Dudek 15 Mar. 1971 22 p refs
(Contract DAAD05-69-C-0102)
(AD-723430) Avail: NTIS CSCL 5/8

The basic purpose of the program is the generation of basic data concerning human performance and recovery within several work systems settings under conditions of varied environments, task demands, motivational levels, and nutritional factors, and further, to generate from this basic data the solution to real problems and recommended procedures for mans operation under varying conditions of the work system. Several conclusions regarding human performance and recovery with pertinence to military application have been made and reported. Specifically six new important conclusions with potential military application have been made relative to continuous operations and work/rest schedules. Author (GRA)

N71-32622# National Research Council of Canada, Ottawa (Ontario). Div. of Mechanical Engineering.
HUMAN FACTORS ENGINEERING
Leslie Buck *In its* Div. of Mech. Eng. and the Natl. Aeron. Estab. Mar. 1971 p 19–26 refs (See N71-32620 19-34)
Avail: NTIS

The interaction between a mechanical system and the human user presents various problems for identification and solution. Considered are man machine aspects of: industrial psychology, human relations, human factors engineering, applied experimental psychology, research on attention, perceptual motor skills, engineering psychology, and mathematical modelling. G.G.

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N71-31670# Wisconsin Univ., Madison. Theoretical Chemistry Inst.
THE VARIATION METHOD, 1
Saul T. Epstein 19 Feb. 1971 141 p
(Grant NSF GP-12832)
(PB-198667) Avail: NTIS CSCL 07D

A discussion is given of the mathematics of the variation principle as applied to chemical bonds. GRA

N71-31675# Tennessee Univ., Tullahoma. Space Inst.
SPECTROSCOPIC BAND MODELS FOR DIAGNOSTICS Final Report, Jul. 1969–Oct. 1970
Arthur A. Mason, Barry McGee, and David Litton Arnold Air Force Station, Tenn. AEDC May 1971 79 p refs
(Contract F40600-69-C-0011)
(AD-723296; AEDC-TR-71-78) Avail: NTIS CSCL 7/4

A major part of the report involves a compilation of information and critical evaluation of that information as it pertains to the diagnostic problem. The information is gathered together in a

bibliography of books, reports, and published articles and is discussed. The investigation of the feasibility of applying the theory of band models to the diagnostic problem of determining temperatures and concentrations has led to the development of a mathematical inversion technique based on low-resolution emission-absorption spectroscopy. Band model theory and much of its literature is summarized in the report. The inversion of the Curtis-Godson approximation of a statistical band model with Lorentz lines of constant width is presented in detail. Experiments were performed to verify the technique but are inconclusive. Author (GRA)

N71-31701# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

ANALYSIS OF PHENOL FORMALDEHYDE CONDENSATION POLYMERS BY GEL PERMEATION CHROMATOGRAPHY [CARACTERISATION DES POLYCONDENSATS FORMOPHENOLIQUES PAR CHROMATOGRAPHIE SUR GEL]

Michel Duval (Ph.D. Thesis—Paris Univ.) 1970 45 p refs In FRENCH; ENGLISH summary

(ONERA-NT-171) Avail: NTIS

The chromatographic analysis of solutions of resols in tetrahydrofurane solvent, by means of a set of columns packed with crosslinked polystyrene gels, has been carried out with adequate resolving power for a clear-cut qualitative or semiquantitative differentiation between various types of resols to be practicable. The resulting chromatograms, which show the distribution of the different constituents by molecular dimensions, could be interpreted by the use of reference substances, and by calibration of the system against a number of compounds of known structures. The method has been used to investigate the way in which various reaction parameters (nature of catalyst, proportion of starting materials) affect the composition of resols. It has also afforded an insight into the progress of the polycondensation reaction as a function of time, and helped to reveal certain phenomena attendant on the aging of resols. Author (ESRO)

N71-31729# Interior Dept., Washington, D.C. Office of Saline Water.

ION-SELECTIVE ELECTROCHEMICAL SENSORS, 2

Issac Trachtenberg and Charles T. Baker 12 Nov. 1970 88 p

(Contract DI-14-01-0001-1737)

(PB-198634; OSW-PR-619) Avail: NTIS CSCL 07D

For the doped-1173 glass Fe(+3) sensors, the redox potential for the reducing agent in the glass has been bracketed between −0.12 V and +0.18 V. In addition, activation experiments revealed that the deterioration of potential response with time is related to a surface phenomenon (probably film formation). The variation in the rate of deterioration from one glass sample to the next was related to alterations in the preparation procedures. Simple chemical and/or mechanical treatment of the surface can restore the sensor almost to its original condition. Development of solid state sensors for Ca(+2) is another accomplishment made during this reporting period. Author (GRA)

N71-31773# Massachusetts Univ., Amherst. School of Engineering.

THE EFFECTS OF OXYGEN ON THE POLYMERIZATION OF ETHYLENE IN THE PRESENCE OF SUPPORTED CHROMIUM OXIDE CATALYSIS

John W. Eldridge and Vincent G. Murphy May 1971 114 p refs

(Contract N00014-68-A-0146; Proj. Themis)

(AD-723585; THEMIS-UM-71-1) Avail: NTIS CSCL 7/1

The polymerization of ethylene over a supported chromium oxide catalyst was studied first in the complete absence of oxygen and then with controlled amounts of oxygen (60 to 600 micro mole/g catalyst) present. The catalyst was prepared by impregnating a microspheroidal silica-alumina (87 - 13 wt. %) with a dilute solution of chromic acid. This raw compound was then activated by heating it in vacuo at 550C. The data indicated that the inhibitory effect of oxygen involved the chemisorption of some oxygen containing species which could in time be displaced by an excess of ethylene. A comparison of the molecular weight distributions of the products with the rates of polymerization at shutdown suggested that higher rates of reaction cause local heating within the reactor, thereby increasing local rates of chain transfer and broadening the distribution. Author (GRA)

N71-31783# Bonn Univ. (West Germany). Inst. for Physical Chemistry.

SIMULATION OF PHYSICAL-CHEMICAL PROCESSES IN THE UPPER ATMOSPHERE. PART 6: REACTIONS OF METASTABLE OXYGEN (1 DELTA G) AND OXYGEN (1 SIGMA PLUS G) MOLECULES [SIMULATION VON PHYSIKALISCH-CHEMISCHEN VORGAENGEN IN DER HOEHEREN ATMOSPHAERE. TEIL 6: REAKTIONEN METASTABILER 02 (1 DELTA G) UND 02 (1 SIGMA PLUS G) MOLEKUELE]

K. H. Becker, W. Groth, and U. Schurath Jul. 1970 54 p refs In GERMAN

(SHA/6) Avail: NTIS

The reaction kinetics of metastable oxygen molecules, as existing in the upper atmosphere, are studied in a closed chemical reactor at pressures of 0.2 m to 0.1 Torr. The quench constants are primarily determined, but the reaction products are also analyzed in view of the role in air pollution. ESRO

N71-31992# Massachusetts Inst. of Tech., Cambridge. Fluid Mechanics Lab.

THE EXCITATION MECHANISM OF THE NITROGEN FIRST POSITIVE AND FIRST NEGATIVE RADIATION AT HIGH TEMPERATURE

Richard C. Flagan and John P. Appleton Apr. 1971 47 p refs *Pts* Fluid Mech. Lab. Pub. No. 71-7

(Contract N00014-67-A-0204-0040; ARPA Order 322)

(AD-723530) Avail: NTIS CSCL 7/4

The kinetic mechanisms responsible for the excitation of the first positive and first negative emission of nitrogen have been investigated in a re-examination of previously reported shock-tube measurements of the non-equilibrium radiation for these systems. The rate coefficients of the collisional quenching reactions were found to be given by empirical expressions over the approximate temperature range 6000 - 14000K. Author (GRA)

N71-32036# Purdue Univ., Lafayette, Ind. Project Squid Headquarters.

KINETIC ENERGIES OF IONIZATION PRODUCTS FROM COLLISIONS OF Ar-Ar, He-He BELOW 220 eV c. m. ENERGY

R. H. Hammond, J. M. S. Henis, E. F. Greene and John Ross (MIT) Mar. 1971 37 p refs Prepared in cooperation with Brown Univ.

(Contract N00014-67-A-0226-0005)

(AD-722688; SQUID-TR-MIT-56-PU) Avail: NTIS CSCL 7/4

Measurements have been made of the energy spectra of ions and electrons produced in the collision of beams of neutral Ar of given energy (laboratory energy range 57-240 eV) with a gas of Ar and of neutral He (145-300 eV) with a gas of He. The energy dependence of the total cross section for ionization is consistent with previous results. The electron spectra from collisions of Ar + Ar show peaks at 0.6, and about 9 eV. From this it was estimated that about 15% of the Ar(+) ions produced come from autoinizing states of Ar. For certain ranges of initial relative energy Ar-Ar ionization occurs mostly in backscattering collisions. An analysis of the ion spectra of experiments at these initial relative energies (greater than 33 eV), made with a simple model, shows that most ions are produced by two curve crossings above the ionization potential. Author (GRA)

N71-32098 National Lending Library for Science and Technology, Boston Spa (England).
EXPERIENCE GAINED IN THE DETERMINATION OF SMALL AMOUNTS OF WATER IN POLYETHYLENE TEREPHTHALATE AND POLYCAPROLACTAM
K. Praeger et al 24 Jun. 1970 6 p refs Transl. into ENGLISH from Faserforsch. (West Germany), v. 21, 1970 p 37-38
(NLL-M-9262-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

An investigation, to find a rapid, reliable, and simple method to determine the water content in dried chips of polyethylene terephthalate and polycaprolactam, was conducted. Methods investigated include manometric, expulsion, and the modified Karl-Fischer. Results show neither method had the desired rapidity of analysis, reproducibility of results, or the precise determination of the entire water content of the dried chips. E.H.W.

N71-32107# Tennessee Univ., Knoxville. Dept. of Chemistry.
HOT ATOM CHEMISTRY Final Report, 1 Nov. 1965-31 Oct. 1970
F. Schmidt-Bleek 31 Oct. 1970 41 p refs
(Contract AF-AFOSR-1867-70)
(AD-722450; AFOSR-71-1074TR) Avail: NTIS CSCL 7/4

Described is a search for hot atom beam sources, primarily halogen and hydrogen sources, for the energy range from 0.1 to 100 electron volts. It was shown for the first time that cathode sputtering of non-metals is feasible and results in formation of neutral species. Also investigated were the hot atom reactions of alkali metals with diatomic molecules as scattering targets. It was shown that the inelastic energy loss of potassium and cesium atoms in collisions with diatomics (chlorine, bromine, and oxygen) is relatively large and surprisingly constant (6-8 eV), quite independent of incident energy of the alkali metal. Author (GRA)

N71-32133# Lehigh Univ., Bethlehem, Pa. Dept. of Chemical Engineering.
EFFECT OF SURFACE GROUPS ON ADSORPTION
Robert W. Coughlin Jun. 1970 38 p refs
(Grant FWPCA-WP-00969-01)
(PB-198519; FWPCA-17020-06/70) Avail: NTIS SOD $0.40 CSCL 07D

It was shown by experiment that acidic surface oxides on active carbon can profoundly influence the sorption of various pollutant-type molecules from aqueous solution. Not only is the equilibrium sorption capacity of the carbon affected but the rate of sorption is also changed. However, these changes are reversible, for removal of the acidic surface oxides can restore the carbon to its original sorption capacity or beyond. In the cases of sorption of phenol, nitrobenzene, sodium benzenesulfonate and dextrose, surface oxides reduced the sorption capacity of the carbon as well as the speed of sorption. In the case of urea sorption the sorption capacity of the carbon was increased by the presence of acidic surface oxides. Author (GRA)

N71-32167 New York Univ., N.Y.
INVESTIGATION OF THE SPIN-UNRESTRICTED HARTREE-FOCK METHOD AND ITS APPLICATIONS
Anthony W. Salotto (Ph.D. Thesis) 1969 125 p
Avail: Univ. Microfilms Order No. 70-16100

The possible uses of the ab initio spin-unrestricted Hartree-Fock (UHF) method were studied expanding the molecular orbitals from a basis set of gaussian functions. Potential energy curves for dissociation and the determination of spin densities for free radicals were investigated. Preliminary studies on the H2 and LiH molecules indicate that among the various methods employed, the unprojected UHF approach gives the most satisfactory shape for potential curves. The HNO molecule was then investigated, and five electronic states of the system were considered. Based upon projection at the experimental minimum for the ground state, and at infinite N-H separation, a set of adjusted curves was generated for the system H + NO. The features of these curves are discussed in relation with the mechanism of the recombination reaction between hydrogen atoms and nitric oxide. The method was also applied in order to determine the H2NO equilibrium geometry and compared with other techniques. Results show that the UHF approach produces the most satisfactory set of values, namely a nitrogen hyperfine splitting constant of 11.186 G. and a hydrogen constant of -8.774 G. Dissert. Abstr.

N71-32181# Japan Atomic Energy Research Inst., Tokyo.
SPECTROPHOTOMETRIC DETERMINATION OF TRACES OF URANIUM IN SODIUM
Yukio Toita and Hiroshi Onishi Jan. 1971 10 p refs In JAPANESE
(JAERI-Memo-4267) Avail: AEC Depository Libraries

A method is described for spectrophotometric determination of 1 to 6 microgram of uranium in less than 3g of sodium. A weighed sample is converted into sodium carbonate with moist carbon dioxide. The sodium carbonate is neutralized and acidified with HCl. EDTA, ascorbic acide, and ammonium thiocyanate are added, and uranium is extracted with a mixture of tributyl phosphate and carbon tetrachloride. After washing of the organic phase, uranium is back-extracted with 1M hydrochloric acid. The back-extract is evaporated to dryness. The residue is dissolved in 9 M HCl, and uranium is reduced to the quadrivalent state with zinc. Arsenazo III is added and the absorbance is measured at 665 nm. Author (NSA)

N71-32249# Dayton Univ. Research Inst., Ohio.
COMPUTER PLOTTED SOFT X-RAY SPECTRA TO FACILITATE CHEMICAL COMBINATION STUDIES WITH THE ELECTRON MICROBEAM PROBE Technical Report, Mar.-Sep. 1970
W. L. Baum and J. S. Solomon Wright-Patterson AFB, Ohio AFML Feb. 1971 41 p refs Presented at the 9th Natl. Meeting of the Soc. of Appl. Spectry., New Orleans, Oct. 1970
(Contract F33615-69-C-1330)
(AD-723635; AFML-TR-70-290) Avail: NTIS CSCL 14/2

Changes in fine features of soft x-ray emission spectra due to chemical combination are difficult to measure and compare from the usual ratemeter-analog recording of soft x-ray emission spectra. This method is very tedious, resulting in possible measurement errors and misinterpretation of actual band shapes and changes, especially when x-ray intensities are low. To apply the chemical combination effect techniques to practical analytical use, such as electron microbeam probe analysis, a faster and highly reliable and reproducible method to obtain and analyze the soft x-ray spectra must be employed. With the development in recent years of the Nuclear Instrumentation Modular (NIM) type equipment with digital data output on computer compatible papertape, chemical combination effect techniques can be applied to rapid, practical, and routine analytical use. A system is described that utilizes a time-sharing computer and a plotting teletypewriter to plot the soft x-ray emission spectra from an electron microbeam probe. Data from the papertape is fed to the computer through the plotting teletypewriter and is processed and prepared for plotting in one program. Then the analyst simply calls for the plotting program when his data is ready for plotting and in a matter of minutes he has either a raw data plot or a smoothed, normalized plot. Several plotting options are available that essentially make the plotting teletypewriter an x-y recorder. The smoothed, normalized plots greatly reduce the possibility of error and facilitate measuring changes and comparing spectra. Examples of computer plotted soft x-ray emission spectra are shown along with some specific analytical applications. Author (GRA)

N71-32287# Royal Aircraft Establishment, Farnborough (England).
TITRATION OF BENZODIAZEPINE DERIVATIVES IN A

NON-AQUEOUS MEDIUM [TITRATION VON BENZODIAZEPINDERIVATEN IN WASSERFREIEM MEDIUM]
K.-H. Beyer et al Mar. 1971 15 p refs Transl. into ENGLISH from Arch. Pharm. (West Germany), v. 300, 1967 p 667-673 (RAE-LIB-TRANS-1507) Avail: NTIS

Chlordiazepoxide, diazepam, nitrazepam and oxazepam can be determined potentiometrically using perchloric acid in glacial acetic acid and, using crystal violet as indicator, by titration, in glacial acetic acid or acetic acid anhydride, as monoacid bases. The basicity of the four compounds is discussed. Both methods of end-point determination are applied to direct titration of various forms of drugs. Author

N71-32286 Kent State Univ., Ohio.
DIELECTRIC PROPERTIES OF POLYMERS
Shinichi Nagami 1969 155 p
Avail: Univ. Microfilms Order No. 70-16538

The isothermal complex dielectric constant data of poly(vinyl acetates) in weight average molecular weight classes of 11,000, 140,000, 500,000 and 1,500,000 were determined covering a frequency range from 22 Hz. to 150 kHz. and a temperature range from 25 C to 130 C. Dielectric data are also included for poly(vinyl acetate)/toluene solution, poly(propyrene oxide), poly(hexene-1 sulfone)/benzene solution, and ethyl acetate. The dielectric properties of these materials were analyzed by means of a skewed circular arc method of analysis (SCAMA). SCAMA is a technique to analyze dielectric and mechanical dispersions using the skewed circular arc equation which is an empirical equation and which represents the experimental dielectric constant accurately when the data are plotted in a complex plane. SCAMA was also reviewed and extended to include such functions as a transient dielectric constant, distribution function, mechanical compliance, most probable retardation time, and average retardation time. Dissert. Abstr.

N71-32289 Yale Univ., New Haven, Conn.
PRESSURE DEPENDENCE OF IONIC EQUILIBRIA
Carl George Seefried, Jr. (Ph.D. Thesis) 1969 425 p
Avail: Univ. Microfilms Order No. 70-16251

The pressure dependence of electrolytic conductance at 30.0 C has been studied to 3000 kg/sq cm for solutions of potassium iodide and a series of tetraalky ammonium salts, tetrabuty ammonium bromide, tetrabuty ammonium picrate, tetramethyl ammonium bromide, tetramethyl ammonium picrate, and tetramethyl ammonium tetraphenyl boride, in iso-propanol, n-butyronitrile, and iso-butyronitrile. The relative volumes and dielectric constants of iso-propanol have been measured in the pressure range to 5000 kg/sq cm at 30.0 C. The viscosities, densities and dielectric constants of n-butyronitrile and iso-butyronitrile have been determined to 3000 kg/sq cm at 30.0 C. Equivalent conductances for each system were measured and the data analyzed by the Fuoss-Onsager linearized equation for associated electrolytes. Specific hydrodynamic and electrostatic interactions were discussed for the aprotonic and hydrogen bonding solvents. The densities and dielectric constants of acetonitrile and benzonitrile at 30.0 C were measured at pressures to 3000 kg/sq cm. Dissert. Abstr.

N71-32318 Yale Univ., New Haven, Conn.
SURFACE DIFFUSION OF GAS MIXTURES IN POROUS MATERIALS
Echol Madison Reed, Jr. (Ph.D. Thesis) 1969 172 p
Avail: Univ. Microfilms Order No. 70-16239

Measurements of isothermal, isobaric counterdiffusion fluxes through a pelleted molybdena catalyst were determined using a variation of the Wicke-Kallenbach technique. Three binary gas systems were used: one nonadsorbed, argon-helium; and two adsorbed, propane-helium and 2-2 dimethyl propane-helium. The temperature varied from 20 C to 90 C and the pressure was maintained near one atmosphere. Surface coverage of the adsorbed gas was controlled and maintained over the range of 0.3% to 15% of a monolayer. Adsorption isotherms for propane and 2-2 dimethyl propane on molybdena, measured with a sorptometer, were obtained for an adsorbate partial pressure range from 2 mm Hg to 90 mm Hg and a temperature range from 5 C to 90 C. Surface transport accounted for a substantial part of the total diffusion flux. Surface diffusion coefficients were evaluated according to a Fick's law expression. Dissert. Abstr.

N71-32394 Kentucky Univ., Lexington.
APPLICATION OF GAMMA-GAMMA COINCIDENCE COUNTING TECHNIQUES TO THE NONDESTRUCTIVE ACTIVATION ANALYSIS OF METEORITIC MATERIALS
David Melvin McKown (Ph.D. Thesis) 1969 165 p
Avail: Univ. Microfilms Order No. 70-16979

The application of gamma-gamma coincidence counting techniques to the neutron activation analysis of meteoritic materials is discussed. A fast coincidence gated gamma-ray spectrometer was set up specifically to measure coincidence activities in complex samples such as irradiated meteorites. The signal outputs from two detector-photomultiplier tube assemblies are each fed through a double delay amplifier and single channel pulse height analyzer to a fast coincidence unit. The output of the fast coincidence unit is fed to the slow coincidence gate of a multichannel analyzer. The multi-channel analyzer input pulses are taken, through a variable delay line, from one of the detector outputs. With this counting system, an energy spectrum of coincidence events is accumulated only if the coincidence pulses from both detectors fall within the pulse-height regions selected by the single channel analyzers. Dissert. Abstr.

N71-32440 New York Univ., N.Y.
FUSED SALT THERMOCELLS
Ralph Isidore Schneebaum (Ph.D. Thesis) 1969 169 p
Avail: Univ. Microfilms Order No. 70-16102

Cells, equipment, and techniques have been developed and employed for the measurement of the initial thermoelectric powers of fused salt thermocells with a resulting accuracy and precision exceeding that heretofore reported. The initial thermoelectric powers of single component fused salt thermocells with the following electrolytes have been carefully determined over a broad temperature range: silver nitrate, silver chloride, and silver bromide. The first reported determination of the initial thermoelectric power of a multicomponent fused salt thermocell (the silver nitrate/sodium nitrate cell) has been carried out over the complete composition range and over a broad temperature range. Research and development work on the design of a fused salt thermal diffusion cell was carried out in conjunction with the work on the silver nitrate/sodium nitrate thermocell. The theory of fused salt thermocells was developed according to the concepts of the classical approach and also by application of the modern thermodynamics of irreversible processes. Dissert. Abstr.

N71-32643# Bureau of Mines, Albany, Oregon. Thermodynamics Lab.
THERMODYNAMIC PROPERTIES OF (Na2O)4-Fe2O3, 6 K TO 1200 K
J. M. Stuve, L. B. Pankratz, and D. W. Richardson Jul. 1971 15 p refs
(BM-RI-7535) Avail: NTIS

Calorimetric determinations of the low-temperature heat capacities, standard enthalpy of formation, and high-temperature enthalpies were made of (Na2O)4 - Fe2O3(c). The resulting values of entropy, enthalpy of formation, and free energy of formation at 298.15 K are 104.676 cal/deg mole, -656.2 or - 1 kcal/mole, and -603.4 + or -1 kcal/mole, respectively. Tabulations of thermodynamic properties are given to 1200 K. Author

N71-32693# Bureau of Mines, Amarillo, Tex. Div. of Helium.
THERMAL CONDUCTIVES AND PRANDTL NUMBERS OF NITROGEN FROM 133 TO 740 K BETWEEN 1 AND 240 ATMOSPHERES
Robert E. Wood, F. W. Bauer, and W. J. Boone, Jr. Jul. 1971 34 p refs
(BM-RI-7541) Avail: NTIS

The temperature dependency of the low-density thermal conductivity coefficients of nitrogen, from 100 to 1,200 K, is correlated with the Keyes' equation. The equation represented 509 experimental higher pressure thermal conductivities in the temperature range 131.2 to 973.15 K for pressures to 500 atmospheres, with a mean absolute deviation of 2.35 percent. The equation was used to compute thermal conductivities of gaseous nitrogen for 47 pressures, 1 to 240 atmospheres, and 110 temperatures, from 133 to 740 K, which are common to conditions encountered in Bureau of Mines helium purification processes. Isobaric heat capacities and viscosities from previous work were combined with the thermal conductivities to compute Prandtl numbers of nitrogen. Tabular values of Prandtl numbers are presented for 49 pressures, 1 to 240 atmospheres, and 75 temperatures, from 133 to 740 K. Estimated uncertainties are + or − 5 percent in the tabulated thermal conductivities and + or − 15 percent for the computed Prandtl numbers. However, the uncertainty may rise to + or − 10 percent for thermal conductivities and to + or − 30 percent for Prandtl numbers as the critical conditions of nitrogen are approached. Author

N71-32711# GTE Labs., Inc., Bayside, N.Y.
CATHODIC ELECTROLUMINESCENCE IN INORGANIC LIQUIDS: FORMATION OF EXCITED CATIONS IN ELECTRODE PROCESSES
Adam Heller, Kenneth W. French, and Paul O. Haugsjaa 1970 8 p refs
(Contract N00014-71-C-0008)
(AD-723808) Avail: NTIS CSCL 7/4

The report summarizes research of the electroluminescence of rare earth compounds in phosphoryl chloride. GRA

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N71-31630* Sylvania Electronic Systems-West, Mountain View, Calif.
AUTOMATED COMMAND AND CONTROL DISPATCH SYSTEM
Sam S. Anzelmo, Jr. *In* Kentucky Univ. Proc. of 1970 Carnahan Conf. on Electron. Crime Countermeas. Apr. 1970 p 30−36 refs (See N71-31628 19-07)
Avail: NTIS

The operation and benefits of a command and control dispatch system which improves the allocation, deployment and monitoring of uniformed police field units are described. Author

N71-31631* Sperry Rand Corp., St. Paul, Minn. Federal Systems Div.
ACCESS CONTROL SYSTEM FOR URBAN SCHOOLS
G. E. Mellen *In* Kentucky Univ. Proc. of 1970 Carnahan Conf. on Electron. Crime Countermeas. Apr. 1970 p 37−43 refs (See N71-31628 19-07)
Avail: NTIS

The ways in which a data system might be used to control the movements of students and visitors through urban school buildings were examined to reduce vandalism to facilities and improve the security of the students and faculty. Access control stations are located at doors over which the school administration has decided to maintain control. The station has the following functions: provides the means for the user to identify himself to the computer, permits the computer to lock or unlock the door, and allows the computer to test whether the door is open or shut. The data base contains the following files which are described: index of valid keys, individual key files, door use files, usage log, and unusual condition directives. F.O.S.

N71-31638* Air Force Systems Command, Wright-Patterson AFB, Ohio. Avionics Lab.
ELECTRICALLY SMALL ACTIVE AND PASSIVE ANTENNAS
Edwin M. Turner *In* Kentucky Univ. Proc. of 1970 Carnahan Conf. on Electron. Crime Countermeas. Apr. 1970 p 114−115 (See N71-31628 19-07)
Avail: NTIS

The design of both broadband passive and active antennas for both transmitting and receiving applications are covered as well as their impedance and pattern characteristics. Special attention is given to the frequency band below 200 MHz. The advantages and disadvantages of electrically small antennas are summarized. Author

N71-31639* Sylvania Electronic Systems-West, Mountain View, Calif.
LOW LIGHT LEVEL TV SURVEILLANCE SYSTEM
Donald T. Heckel *In* Kentucky Univ. Proc. of 1970 Carnahan Conf. on Electron. Crime Countermeas. Apr. 1971 p 116−131 (See N71-31628 19-07)
Avail: NTIS

Two night-vision devices used for police surveillance are discussed. The low-light-level television camera (LLLTV) which produces a daylight picture at nighttime illumination levels and a direct-view device (DVD) which is similar to a small telescope or pair of binoculars are described. The light amplification principles which both devices operate on are outlined. The advantages and disadvantages of LLLTV and infrared detecting systems are covered. Typical applications of LLLTV and DVD in nighttime police and security operations are cited including stake out and helicopter observations. J.M.

N71-31650# Magnavox Research Labs., Torrance, Calif.
TACTICAL RADIO COMMUNICATIONS PRIVACY: ONE APPROACH
W. J. Judge *In* Kentucky Univ. Proc. of 1970 Carnahan Conf. on Electron. Crime Countermeas. Apr. 1970 p 231−238 refs (See N71-31628 19-07)
Avail: NTIS

The pseudo-noise (PN) carrier system represents a simple and effective method of obtaining privacy in a radio communications link. At the same time, it provides other features often of mutual interest such as low detectibility (signal hiding), identification, distance measurement (ranging) and resistance to interference in the band of transmission. While the basic technology is well understood, simple PN carrier modem implementations which might be applicable to police voice communications have only recently been developed, the previous emphasis having been on sophisticated military systems. Such a representative modem is described. It represents the rock-bottom in sophostication for PN technology and features a push-to-talk voice channel of tactical quality with a spread bandwidth of about 1 MHz. The modem is suitable for application at VHF and up. Included in this representative modem

design is a PN code generator which provides over 2,000 selectable codes having suitable correlation properties and a range readout which describes the distance between users. Author

N71-31661# Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven (West Germany).
CALCULATING TROPOSCATTER INTERCHANNEL DISTORTION USING A MONTE CARLO METHOD
A. Wasiljeff Aug. 1970 12 p refs Presented at the EPP/AGARD Symp. on Radio Wave Propagation, Dusseldorf, 31 Aug. – 4 Sep. 1970 Sponsored by Fed. Min. for Defence
(Rept-10-70) Avail: NTIS

A computer simulation of the standard measurement technique of the interchannel distortion in multichannel telephony troposcatter links is described. Multichannel signals can be simulated by sets of randomly phased sinusoids uniformly spaced in frequency. The amplitudes of the sinusoids are set according to the prescribed pre-emphasis characteristic, some of them are set to zero to form the idle channels. The signal is transformed into the time domain with the aid of fast Fourier synthesis. This time signal is the modulation function for the transmitted electromagnetic field. The field which reaches the receiver after having been scattered by a tropospheric volume is described with the help of an integral including the spatial Fourier transform of the autocorrelation function of the dielectric constant in the tropospheric scatter volume. Analytical performance of demodulation of the calculated field in the receiver yields the distorted time function. Again the fast Fourier transform is used to analyze this function. The power density in the channels which had been originally idle is a measure of interchannel distortion. The process is repeated with a sequence of random noise samples, each sample with a set of independent random phases. The distortion is averaged to obtain the desired solution. The results of this Monte Carlo method approach those obtained by measurements with Gaussian noise. Author (ESRO)

N71-31672# Hawaii Univ., Honolulu.
TELETYPE COMMUNICATIONS AT OPTICAL FREQUENCIES FOR THE ALOHA SYSTEM
Earl Kaneshira Feb. 1971 21 p refs
(Contract F44620-69-C-0030; Proj. Themis)
(AD-723332; THEMIS-B71-1; AFOSR-71-1203TR) Avail: NTIS CSCL 17/2

The paper describes a teletype to teletype incoherent optical communications link presently operating on the campus of the University of Hawaii. A carrier on-off, direct detection communication scheme is used to transfer the binary information between teletypes. The transmission medium is the turbulent atmosphere, with emphasis on beam steering and beam spreading effects. Other types of effects, such as coherence degradation, polarization fluctuations, and beam scintillation are of no real consequence in this type of incoherent, unpolarized system. Atmospheric scattering is neglected. Receiver signal-to-noise ratio, effects of rain, and beam diameters in the transmitting and receiving planes are some of the system parameters measured and discussed. The actual light source and detector used are also discussed in some detail. The link covers about 160 yards. Author (GRA)

N71-31678# Northrop Corp., Palos Verdes Estates, Calif. Electronics Div.
DIGITAL ADDRESS THIN DISPLAY TUBE Quarterly Progress Report, 17 Aug. – 16 Nov. 1970
Walter F. Goede Apr. 1971 19 p
(Contract DAAB07-70-C-0110)
(AD-723413; NORT-70-353-3; ECOM-0110-3; QPR-3) Avail: NTIS CSCL 17/9

The report describes the progress which occurred during the third quarter of a Research and Development contract to develop a 32x52 resolution element digital-address, thin display tube for a man-pack radar. During the quarter the parametric tradeoff study was continued, a low-power area-cathode was fabricated and tested, dynode substrates were received, and the design of low-power driving circuitry was continued. A modification in the order in which the resolution elements are scanned is discussed, test results of the low-power area-cathode are presented, and a detailed analysis of the power requirements for the display electronics is presented. Author (GRA)

N71-31682# Naval Research Lab., Washington, D.C. Communications Systems Branch.
PROBABILITY OF ERROR CONSIDERATIONS FOR CERTAIN M-ARY BLOCK CODES WITH BIT BY BIT DECISIONS Interim Report
Noel C. Balthasar and Hugo M. Beck 26 Apr. 1971 35 p refs
(AD-723519; NRL-7250) Avail: NTIS CSCL 9/4

A communication system, which transmits letters from an M-ary source alphabet through an additive white Gaussian noise channel, is considered. The source letters are encoded for transmission using an M-ary block code. Code words are transmitted bit by bit through the channel. The receiver makes hard bit decisions on the received signals, performs a correlation operation to determine the likeliest transmitted code word and then decodes this word to yield a received letter. Two types of M-ary block codes are considered. For each type the authors attempt to derive the probability (P sub eB) of a block error, given various values of M (number of block), N (bits per block or block length), and P sub eb (the probability of a bit error). The analysis points out the need for investigation of a special-purpose statistical device in order that (P sub eB) can be determined for large values of M and N. Author (GRA)

N71-31725# Hawaii Univ., Honolulu. Dept. of Electrical Engineering.
CHANNEL CAPACITY FOR NONORTHOGONAL MULTIPLE ACCESS COMMUNICATIONS
Herng-Jiunn Liao Feb. 1971 18 p refs
(Contract F44620-69-C-0030; Proj. Themis)
(AD-723681; THEMIS-A71-6; AFOSR-71-1354TR) Avail: NTIS CSCL 9/4

In this paper a wide-sense receiver is suggested in the place of conventional individual receivers for a general nonorthogonal multiple access communication system. It is shown that the channel capacity achieved by this wide-sense receiver is greater than the summation of conventional individual channel capacities (narrow-sense capacity). The author gives some examples of both continuous and discrete channels. The result indicates an alternative way of building a more complex receiver which achieves better channel utilization. Author (GRA)

N71-31784# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Abteilung Sonderprojekte.
UTILIZATION OF SIMPLE OMNIDIRECTIONAL VHF ANTENNAS ON BOARD OF SHIPS FOR SATELLITE RECEPTION BY ELIMINATING THE MULTIPATH EFFECTS THROUGH A DIVERSITY SYSTEM [VERWENDUNG EINFACHER OMNIDIREKTIONALER UKW-ANTENNEN AUF SCHIFFEN FUER DEN SATELLITENEMPFANG UNTER AUSSCHALTUNG DES MEHRWEGEEFFEKTS MITTELS EINES DIVERSITY-SYSTEMS]
Walter Goebel 1971 75 p refs In GERMAN; ENGLISH summary
(DLR-FB-71-05) Avail: NTIS; DFVLR Porz: 22.40 DM

Further development of the experiments in 1968, carried out on board of the research ship METEOR are reported. The mathematical interrelationship of multipath effects is demonstrated.

This knowledge allows a very simple configuration of omnidirectional antennas for fading avoidance by antenna diversity. By inclusion of the reflected beam the limit of usable elevation angles for satellite reception, normally regarded to be 10 deg, is reduced down to the Brewster angle (VHF: 3 deg). Furthermore, margins against multipath-fading may be omitted. However, a satellite with a circularly polarized antenna must be assumed. Improved distance measurements according to tone-ranging method are described. An accuracy of position finding of from 1 to 2 nautical miles seems to be attainable even though ionospheric distance errors exist. A contribution is given to the question, under what conditions satellite and terrestrial communication may exist within the same frequency band without mutual interference. The results are promising.
Author (ESRO)

N71-31811# Naval Research Lab., Washington, D.C. Search Radar Branch.
ANALYSIS OF INTERLEAVED ARRAYS OF WAVEGUIDE ELEMENTS Interim Report
James K. Hsiao 16 Apr. 1971 29 p refs
(AD-723520; NRL-7248) Avail: NTIS CSCL 9/5

Multiple interleaved arrays of waveguide radiators have been analyzed at different frequencies. The approach is a generalization of the analysis of an infinite array at a single frequency. The presence of the low-frequency elements affects the radiation characteristics of the high-frequency elements and generates grating lobes which do not appear in a single-frequency array. Furthermore, power is coupled into the low-frequency waveguides when the high-frequency elements are excited. Numerical examples are presented which show that these effects are not severe. The analytical expressions reduce correctly to the single-frequency array case and satisfy the principle of energy conservation.
Author (GRA)

N71-31842*# National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.
ESTIMATES OF C BAND RADAR STATION POSITIONS AND INTERSITE DISTANCES
Clifford D. Leitao and Ronald L. Brooks (Wolf Res. and Develop. Corp., Pocomoke, Md.) *In its* Proc. of the GEOS-2 Program Rev. Meeting, Vol. 1 Nov. 1970 p 371–385 refs (See N71-31826 19-07)
Avail: NTIS HC$6.00/MF$0.95 CSCL 17I

Estimates of the geodetic positions of selected C-Band radars that tracked the GEOS-2 satellite during the period 28 January 1969 to 18 February 1969 are presented. The geodetic positions were estimated dynamically on the SAO C-6 datum using the SAO 1969 gravity model. Intersite distances between some of the sites are also presented.
Author

N71-31862*# Air Force Eastern Test Range, Patrick AFB, Fla.
GEODETIC LOCATION OF A SHIP AT SEA WITH C-BAND RADAR RANGE DATA
Milton Hillhouse *In* NASA. Goddard Space Flight Center Proc. of the GEOS-2 Program Rev. Meeting, Vol. 2 Nov. 1970 p 115–144 refs (See N71-31856 19-13)
Avail: NTIS CSCL 17I

A method of obtaining a geodetic position of a ship by tracking a satellite whose orbit is accurately determined by land based sensors is discussed. All data were obtained from the beacon track of GEOS 2 satellite. The data collection and reduction, test results, and simulated data are described. It is concluded that the ship's location can be accurately determined from pulse radar range-only data. The accuracy achieved and the number of separate satellite passes required depend on the accuracy of the reference orbit, the accuracy of the ship's tracking data and ship's motion determination, and the geometry of the different passes used.
N.E.N.

N71-31863*# RCA International Service Corp., Patrick AFB, Fla.
GEODETIC SURVEY IMPROVEMENT WITH C-BAND RADAR
D. R. Pfingsten *In* NASA. Goddard Space Flight Center Proc. of the GEOS-2 Program Rev. Meeting, Vol. 3 Nov. 1970 p 145–166 (See N71-31856 19-13)
Avail: NTIS CSCL 17I

Survey adjustments and improved accuracies were obtained for four downrange Mistram/MRS sites. The role played by C-band tracking radars in obtaining these results is described. Comparisons between C-band radar results and other systems are also discussed.
Author

N71-31864*# Battelle Memorial Inst., Columbus, Ohio.
ACOUSTIC DATA REDUCTION AND CALIBRATION FOR THE GEOS-2 C-BAND RADAR MARINE GEODESY EXPERIMENT IN THE BAHAMAS
A. G. Mourad, A. T. Hopper, D. M. Fubara, and G. T. Ruck *In* NASA. Goddard Space Flight Center Proc. of the GEOS-2 Program Rev. Meeting, Vol. 3 Nov. 1970 p 167–188 refs (See N71-31856 19-13)
(Contract NAS6-1733)
Avail: NTIS CSCL 17I

An improved technique for determining the geometry and orientation of underwater acoustic transponders is described. The ocean surface positioning technique, known as transponder location by surface positioning (TLSP), involves the use of computer code incorporating any available accurate surface-ship coordinates, acoustic slant ranges from the ship to the transponders, and velocity of sound profile. Analysis of the results of TLSP adjusted geodetic coordinates in both curvilinear and cartesian coordinates revealed that standard errors of less than 0.24 arc seconds were obtained in the determination of the latitudes and longitudes for all three transponders. The standard error of depth determination was about 3 meters at depths of about 5000 meters. About 1500 observation equations were used with nine unknowns in a least squares solution to determine the transponder coordinates and orientation. Corrections applied to the data include velocity of sound and refraction corrections, antenna offset correction between the LORAC antenna and the Bathymetric Navigation System transducer, and correction for ship speed.
Author

N71-31865*# Pan American World Airways, Inc., Patrick AFB, Fla.
NEAR REAL TIME RADAR CALIBRATION
N. Bush *In* NASA. Goddard Space Flight Center Proc. of the GEOS-2 Program Rev. Meeting, Vol. 2 Nov. 1970 p 189–200 refs (See N71-31856 19-13)
Avail: NTIS CSCL 17I

The calibration information that can be obtained for the C-band radar by collecting and analyzing radar data from satellites with C-band beacons is discussed. The usefulness of the GPTP program in producing good near real time calibration values is evaluated, based on a comparison of these values with the postflight reduction done on the NITE program. The sets of data used for these comparisons were obtained utilizing GEOS 2 in March and May 1968. The data comparisons show that the angle calibrations from the GPTP program are usable in a near real time sense to obtain improved radar test data. It is conceivable that updated angle biases can be obtained from a multiple radar GPTP solution and the angle bias calibrations be applied to a single radar test in one day.
Author

N71-31866*# National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.
SHIP BORNE RADAR TRACKING FOR PRECISE SHIP POSITIONING
C. F. Martin (Wolf Res. and Develop. Corp., Riverdale, Md.) and W. B. Krabill *In* NASA. Goddard Space Flight Center Proc. of the

GEOS-2 Program Rev. Meeting, Vol. 3 Nov. 1970 p 201-221 (See N71-31856 19-13)
Avail: NTIS CSCL 17I

The C-band radar tracking of the GEOS 2 satellite by the Vanguard Apollo Tracking ship was used, in conjunction with land-based C-band radar tracking, to obtain estimates of the ship position. For a two revolution dockside solution, a position agreeing with the surveyed position to within 17 meters was obtained. At sea radar tracks by the Vanguard were reduced using the ship inertial navigation system (SINS) data for the change in ship position after the beginning of track. Both one and two revolution solutions were used for ship positioning. In all cases, poor fits of the radar data to the orbit determined by the landbased stations gave indications of problems with the SINS data and station recoveries in error by 2 km or greater. Comparison with a LORAC position for one case also showed discrepancies on the order of 3 km. Author

N71-31879*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MSFN UNIFIED S-BAND METRIC TRACKING CAPABILITIES
Irving Salzberg *In its* Proc. of the GEOS-2 Program Rev. Meeting, Vol. 4 Nov. 1970 p 253-268 (See N71-31867 19-13)
Avail: NTIS CSCL 17I

The effects of geodetics, time, and frequency on the metric tracking capability of the unified S band are considered. Error sources and their effects on range and range rate tracking are contained in data tables. G.G.

N71-31880*# Pan American World Airways, Inc., Patrick AFB, Fla.
MISTRAM APPLICATIONS WITH GEOS C
N. Bush *In* NASA. Goddard Space Flight Center Proc. of the GEOS-2 Program Rev. Meeting, Vol. 4 Nov. 1970 p 269-280 (See N71-31867 19-13)
Avail: NTIS CSCL 17I

The Missile Trajectory Measurement System (Mistram) is an accurate CW radar system designed to track cooperative targets such as missiles, aircraft or space vehicles. The current ETR Mistram configuration consists of two baseline stations and seven rate vans usually called Mistram Rate Stations (MRS vans). For the GEOS-C study, the Mistram system is limited to one baseline system and three MRS vans. Author

N71-31881*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GEOS-C RADAR ALTIMETER
John W. Bryan *In its* Proc. of the GEOS-2 Program Rev. Meeting, Vol. 4 Nov. 1970 p 281-292 (See N71-31867 19-13)
Avail: NTIS CSCL 17I

A radar altimeter is planned for the GEOS-C geodetic satellite. The radar has not been designed. Presented is a review of the ideas and requirements as well as a sample design criteria for a radar to fulfill those requirements. Author

N71-31948# Institute for Telecommunication Sciences, Boulder, Colo.
A NEW METHOD FOR PREDICTING HF GROUND WAVE ATTENUATION OVER INHOMOGENEOUS, IRREGULAR TERRAIN
R. H. Ott Jan. 1971 62 p refs
(AD-721179; OT/ITSRR-7) Avail: SOD $3.60 CSCL 17B

Several examples of the numerical evaluation of an integral equation for the calculation of the attenuation of a radio wave are given. These waves are assumed to be propagated over realistic, smoothly varying irregular, inhomogeneous terrain. Results for propagation over a cylindrical earth show an accuracy to 3-4 significant figures when compared with the classical residue series. Calculations for propagation over smooth mixed land-sea paths agree with classical methods. The applicability of the program to permit computation of propagation over terrain with smooth height variation is demonstrated by calculations of propagation over one and two Gaussian-shaped hills. The ability of the program to allow treatment of variations in both ground conductivity and height combined is illustrated by calculations of propagation from the sea up a sloping beach and by calculations of propagation over an island. The last example illustrates the importance of the terrain profile in mixed path calculations. Author (GRA)

N71-31991# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
PHASE SCINTILLATION EFFECTS ON THE CROSS SECTIONS OF IONIZED IRREGULARITIES Final Report, Mar. 1970-Mar. 1971
W. I. Futterman 30 Mar. 1971 46 p refs Sponsored in part by DASA
(Contract N00014-67-C-0141)
(AD-723587; LMSC/N-15-71-1) Avail: NTIS CSCL 17/9

Phase scintillation effects upon the electromagnetic cross sections of volumes containing ionized irregularities are calculated for both forward and backward scattering. Expressions for the average amplitude and cross section are obtained for arbitrary scattering angle. Numerical applications are made to the forward scattering results. Born approximation to the attenuation length and to the scattering cross section per unit volume does not have proper dependence on the thickness of the scattering medium. Deviations from the Born results are significant for extended volumes of irregularities. For a nominal medium of mean square index of refraction fluctuation equal to 10 to the -8th power, and correlation length of 1 km, the attenuation length of a 400 MHz wave after 10 km of penetration is about an order of magnitude greater than the Born result. Author (GRA)

N71-32129# Naval Underwater Systems Center, Newport, R.I.
A MODEL OF INFORMATION FLOW IN VISUAL SONAL DISPLAYS
Thomas V. McAndrew 21 Jan. 1971 40 p refs
(AD-723180; NUSC-4029) Avail: NTIS CSCL 17/1

The report treats the visual display as a link in a communication channel and develops the mathematical expressions for information flow through the display. A short review of information theory is presented and a decision rule applicable to displays is discussed. Assuming that an ideal processor is used to implement the decision rule, the information flow is determined for the A-scope, PPI, and active integrating display. The results can easily be extended to other types of displays. Author (GRA)

N71-32130# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
WIDEBAND LASER COMMUNICATIONS: AN ANNOTATED BIBLIOGRAPHY
Joe H. Templeton 25 Apr. 1971 138 p refs
(Contract N00014-71-C-0049; ARPA Order 306)
(AD-723834; LMSC-N-JY-71-3; LMSC-SB-71-1) Avail: NTIS CSCL 17/2

Highly specific abstract/citations on the subject of Wideband Laser Communications make up this bibliography. Journal articles, books, and government reports have been chosen for inclusion from abstracts appearing in the NASA STAR, TAB, U. S. G. R. D. R., and IAA. Coverage was for the years 1964-1970. Citations are arranged alphabetically by author. Among the subjects covered are: optical communication at high data rates, optical beam acquisition and fine tracking, and atmospheric effects on laser beam propagation. Author (GRA)

N71-32221# RAND Corp., Santa Monica, Calif.
SCATTERING OF ELECTROMAGNETIC WAVES IN A SPINOR FORMALISM. 2: COMMENTS ON THE EIKONAL APPROACH TO SCATTERING FROM COATED PERFECT CONDUCTORS
Ronald Rockmore Nov. 1970 20 p refs
(P-4471) Avail: NTIS

The eikonal approach is applied to the problem of the scattering of scalar and electromagnetic waves from an excluded volume in the presence of a weak external potential. In the case of scalar (Schroedinger) waves, a compact closed form for the scattered wave function is derived and the scattering of electromagnetic waves is treated in as spinor formalism. The excluded volume is eventually taken to be a perfectly conducting cone, the external potential a coating of thickness, with complex dielectric constant and permeability. Author

N71-32226# Illinois Univ., Urbana. Dept. of Computer Science.
ORBIT: ONLINE REDUCED BANDWIDTH INFORMATION TRANSMISSION
Peter Ernst Rudolf Oberbeck (Ph.D. Thesis) Feb. 1971 87 p refs
(Contract AT(11-1)-1469)
(COO-1469-178; Rept-430) Avail: NTIS

A real time television bandwidth compression scheme is outlined in which the required bandwidth is a function of the complexity of the picture to be transmitted. The class of pictures to be transmitted are black on white line drawings. The encoding and decoding of the picture are done by two digital processors. The transmission link between the two digital processors is an analog line with a D/A conversion at the transmitter and an A/D conversion at the receiver. The operation of the transmitter and receiver and their interaction with peripheral systems such as the camera and television monitor are described in detail. The encoding involves a time to voltage conversion and redistribution of the various points of information on the picture. The decoding process reconverts voltages to times and uses these times to place points of information in their original position on the picture. The bandwidth requirements for the system are analyzed, with the conclusion that an average bandwidth compression of twenty-five to one can be realized. The operation of each circuit card used in the system and a schematic diagram of each circuit are included. Author

N71-32293*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SCINTILLATION, POLARIZATION, AND MULTIPATH EFFECTS ON VHF PROPAGATION BETWEEN SYNCHRONOUS SATELLITES AND AIRCRAFT
E. J. Mueller Dec. 1970 45 p refs
(NASA-TM-X-65628; X-490-71-45) Avail: NTIS CSCL 20N

A summary of tropospheric and ionospheric scintillation and multipath data at VHF frequencies of interest for an aeronautical system is presented. The north Atlantic oceanic region is considered. Only the effect of these factors on signal level fluctuations are considered, and without involvement in aeronautical operational procedures or specific aeronautical telecommunications systems designs. Author

N71-32319 California Univ., Berkeley.
SEQUENTIAL M'ARY COMMUNICATION SYSTEMS
Shingo Nishikawa (Ph.D. Thesis) 1969 245 p
Avail: Univ. Microfilms Order No. 70-6179

M-level pulse amplitude modulation and M-orthogonal modulation sequential communication systems were investigated. Given that one of the M signals is repetitively sent over an additive Gaussian channel during successive intervals of time, the problem of what optimum sequential procedure to follow at the receiver in order to pick the correct signal with a probability of wrong selection no greater than epsilon was considered. The optimum procedure was defined to be one which minimizes the expected number of transmissions (sample size) before a decision is reached. Optimal procedures which realize the lower bound when epsilon approaches 0 were obtained. An approximation to the expected sample sizes for the two modulation systems was derived and a computer program was written to verify the analysis of the expected sample size for the orthogonal case. Dissert. Abstr.

N71-32325# Naval Postgraduate School, Monterey, Calif.
THE EFFECT OF SEQUENTIALLY CHANGING BACKGROUND COLOR DURING TARGET DETECTION
James Calvin Brown (M.S. Thesis) Mar. 1971 34 p refs
(AD-722572) Avail: NTIS CSCL 5/10

The experiment investigated the effect of sequentially changing the background color during target detection. Two color sequences, three speeds, and twenty-four subjects were used on an experimental appartus designed and built at the Naval Postgraduate School. A three-way factorial analysis of variance was used to analyze the data. It appears that both the sequence of background colors and the speed at which the color changes have an effect on target detection time. Author (GRA)

N71-32337 National Lending Library for Science and Technology, Boston Spa (England).
A METHOD OF BAND COMPRESSION BY DELTA MODULATION
K. Matsui et al 17 Nov. 1970 4 p ref Transl. into ENGLISH of Japanese conf. paper from Mitachi Works, Central Lab. at 1970 Elec. 4-Sci. Joint Conf., Denki Shigakkai Rengo Taikai, Japan
(NLL-Trans-2681-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

An investigation and experiments regarding a method of analogically controlling the step size, in correspondence with the input signal tilt, and the results obtained up to the present time are reported. Author

N71-32338 New Mexico State Univ., University Park.
THE EFFECT OF IF FILTERING ON THE PERFORMANCE OF BINARY DATA DEMODULATORS OPTIMUM IN THE PRESENCE OF WHITE NOISE
William Pierce Osborne (Ph.D. Thesis) 1970 129 p
Avail: Univ. Microfilms Order No. 70-16357

An analysis is given of the performance of a receiver composed of a bandpass filter, or 1F filter, followed by a detector which is optimum in the presence of an additive white normal noise process. The analysis is performed assuming the signal is a binary modulated sinusoidal carrier, and the carrier is amplitude and/or angle modulated with one of two known waveforms. The receiver's function is to observe the signal in the presence of noise and decide which of the two waveforms was used to modulate the carrier. The performance criterion is taken to be the average probability of error, and the average probability that the receiver renders an incorrect decision. A general expression is obtained for the probability of error as a function of the impulse response of the filter, the modulating waveforms, and the ratio of the received energy to noise spectral density. This method of modeling intersymbolism inference is shown to yield satisfactory results if the probability of error is greater than 10 to the minus 8th power. Dissert. Abstr.

N71-32377 University of Southern Calif., Los Angeles.
NONLINEAR RECURSIVE ESTIMATION IN AN OPTICAL HETERODYNE RECEIVER
George de Lamater Thompson, Jr. (Ph.D. Thesis) 1970 230 p
Avail: Univ. Microfilms Order No. 70-16893

The analysis and design of an optical heterodyne receiver are discussed for estimation of a continuous-wave, gas laser signal phase after distortion during propagation through the earth's

atmosphere. The laser signal is modeled as a sinusoid which is frequency-modulated by a first-order Markov process. The model for the laser signal is theoretically analyzed; laboratory measurements of laser statistics are presented as verification of the theoretical model. A simulation of the nonlinear, recursive estimator on a digital computer indicates the performance that can be expected for varying amounts of atmospheric distortion and additive noise. The results show that optical communication by phase or frequency modulation is feasible for moderate atmospheric distortion over reasonable distances. Dissert. Abstr.

N71-32408*# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
ADAPTIVE TELEMETRY SYSTEMS Final Report, 1 May 1968 – 1 Feb. 1971
Paul A. Wintz Apr. 1971 17 p refs
(Grant NGR-15-005-087)
(NASA-CR-119679; TR-EE-71-12) Avail: NTIS CSCL 17B

Abstracts, covering probability of bit errors, error correction codes, data compression techniques, data transmission, and binary codes for PCM adaptive telemetry systems, are presented. E.H.W.

N71-32480# Institute for Telecommunication Sciences, Boulder, Colo. Research Labs.
TABULATIONS OF PROPAGATION DATA OVER IRREGULAR TERRAIN IN THE 230-TO 9200-MHz FREQUENCY RANGE. PART 3: NORTH TABLE MOUNTAIN-GOLDEN
P. L. McQuate, J. M. Harman, M. E. McClanahan, and A. P. Barsis Jul. 1970 243 p
(ESSA-TR-ERL-65-ITS-58-3-Pt-3) Avail: SOD $1.75

Tabulations and graphs are presented on transmission loss data resulting from propagation experiments in the 230- to 9200-MHz frequency range conducted over irregular terrain in Colorado. Details are given on the data obtained at a common receiver site, located on a high mesa near Golden, Colorado, over propagation paths varying in length from 0.5 to 80 km. Author

N71-32482*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
S-BAND PROPAGATION DISTURBANCE DURING ALSEP MISSION SUPPORT Preliminary Report, 19 Nov. 1969 – 30 Jun. 1970
Ross M. Christiansen Jun. 1971 104 p refs
(NASA-TM-X-65631; X-861-71-239) Avail: NTIS CSCL 20N

Severe fluctuations of the ALSEP S-band downlink telemetry signal have resulted in unexpected data dropouts. Due to the important implications, it was decided to gather and analyze the available data for the period November 19, 1969 – June 30, 1970. In all, some 41 station support periods with fluctuation reports have been tentatively attributed to an unspecified phenomena. The occurrences have been highly localized to the Ascension Island (ACN) and the Canary Islands (CYI) stations, even though other stations of the MSFN Network have had equivalent exposure. The signal fluctuations at these stations have been as large as 20 and 25 db. A comparison of the fluctuations with solar events has failed to show any correlation. Further analysis resulted in a working hypothesis as to a pattern of occurrence. This pattern indicates that the disturbance occurs primarily during the local hours of 2000 to 2400, on days clustered about the phase of the full moon, in months centered at the equinox. This pattern strongly suggests a connection between the fluctuations and some phenomena occurring in the lower magnetosphere or ionosphere. Author

N71-32513 University of Southern Calif., Los Angeles.
SPECIFICATION AND PERFORMANCE EVALUATION OF OPTIMAL STATE VARIABLE FILTERS FOR COMMUNICATION PROBLEMS
David Charles Beste (Ph.D. Thesis) 1970 102 p
Avail: Univ. Microfilms Order No. 70-16852

A class of approximation to the exact differential equation for the conditionally expected signal process was derived and members of this class were compared with each other and with existing approximations. The structures of the differential equations when appropriate communication environment constraints and approximations are imposed were determined. Optimal recursive filters were derived for specific cases of phase and frequency modulated signals. Utilizing a rigorous stochastic calculus developed by Ito, a general procedure was developed for analyzing the performance of any system which could be represented as a stochastic differential equation having the Markov property. This procedure for performance analysis was applied to the optimal recursive filters previously derived. The performance of the optimal recursive filters was determined as a function of the modulation index, the signal-to-noise ratio for which the filter was designed, and the actual signal-to-noise ratio. Dissert. Abstr.

N71-32527*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NASA BALLOON AIRCRAFT RANGING DATA AND VOICE EXPERIMENT
Sheldon Wishne Jul. 1971 32 p
(NASA-TM-X-65649; X-752-71-212) Avail: NTIS CSCL 17B

The ranging, data, and voice communication system, planned for using Satellite in air traffic control, to be studied during the balloon-aircraft test program are discussed. System concepts, signal format, power requirements, equipment and the test program are presented. F.O.S.

N71-32530# Chicago Univ., Ill. Dept. of Geophysical Sciences.
THE EFFECT OF SIGNAL FLUCTUATIONS ON THE PERFORMANCE OF DUAL WAVELENGTH RADAR HAIL DETECTOR
R. C. Srivastava and R. E. Carbone Mar. 1971 25 p refs Prepared in cooperation with IIT Research Inst., Chicago, Ill.
(Grants ESSA-E22-14-71(G); NSF GA-19031)
(TR-20) Avail: NTIS

The range derivative of the ratio of the powers at two wavelengths, from matched volumes as a parameter for the remote detection of hail by radar is discussed. This parameter is a random variable because of inherent signal fluctuations. The probability density of the parameter is derived as a function of the number of independent radar returns averaged. It is shown that as the number of independent samples increases, the parameter tends to be log-normally distributed. The problem of false alarm in the detection of hail is considered. A method of increasing the sensitivity of hail detection by considering the simultaneous values of the range derivative in more than two radar range elements is discussed. Author

N71-32561 Illinois Inst. of Tech., Chicago.
MATHEMATICAL CHARACTERIZATION OF IONOSPHERIC COMMUNICATION ERROR SEQUENCES
Peter Michael McManamon (Ph.D. Thesis) 1970 247 p
Avail: Univ. Microfilms Order No. 70-15433

A definition of a finite state discrete parameter Markov chain representation of communication error time sequences and the application to error sequence samples measured on a 2800 km mid-latitude HF ionospheric propagation path are given. The waiting times between errors or gaps are fundamental to the Markov chain definitions. States are defined in terms of gaps and all parameters estimated directly from the error sequences, gap distributions or error-free run distributions. A four state chain is shown to be an accurate representation to within a few percent of the measured binary error mean. Only (N-2) parameters must be found for an N state chain through a straightforward iteration

method. The Markov chain selected for a specific application is shown to depend upon whether or not successive gaps are statistically independent. Further, the gaps must be identically distributed in single and joint gap distributions to permit representation with homogeneous transition probabilities. A set of HF ionospheric channel parameters are defined. Dissert. Abstr.

N71-32567*# National Aeronautics and Space Administration, Washington, D.C.
COMMUNICATIONS AND TELEMETRY: A COMPILATION
1971 41 p
(NASA-SP-5935(01)) Avail: NTIS CSCL 17B

A tracking antenna is used in a system where two objects are changing position with respect to each other. The test antenna is moved in the X-Y plane corresponding to the movement around the X-axis of the tracking antenna which is pointed away from a fixed test antenna and then allowed to zero-in on it. The improved test method uses more than one test antenna in a fixed position, forming an array which creates numerous radiation patterns for testing. Author

N71-32613 Texas A&M Univ., College Station.
OPTIMUM FILTERING OF A NOISY PHASE SHIFT KEYED SIGNAL
Giles Whitehurst Willis, Jr. (Ph.D. Thesis) 1970 184 p
Avail: Univ. Microfilms Order No. 70-16772

A method is outlined in which the autocorrelation function of the input is transformed into a complex frequency domain where it can be factored. The phase loci of the complex frequency variable are used to find uniquely the necessary pole-zero locations. A unique network function in terms of the complex frequency variable may then be determined. This method avoids approximations in the solution to the Wiener problem. Moreover, since the approach is one which would apply to any autocorrelation function, it is shown that any autocorrelation function may be similarly transformed. Finally, the autocorrelation function of the phase shift keyed signal corrupted by white noise is used to find the optimum filter for the system. Suitable realization techniques are then employed to synthesize this optimum transfer function. Dissert. Abstr.

N71-32615 Michigan State Univ., East Lansing.
RADIATION OF SPHERICAL AND CYLINDRICAL ANTENNAS IN INCOMPRESSIBLE AND COMPRESSIBLE PLASMAS
Cheng-Chi Lin (Ph.D. Thesis) 1969 163 p
Avail: Univ. Microfilms Order No. 70-15072

A study was conducted to investigate theoretically and experimentally the radiation of a spherical antenna and a cylindrical antenna when immersed in a plasma and to detect the existence of an electroacoustic or a longitudinal plasma wave excited by the antenna. In the theoretical analysis, spherical and cylindrical dipole antennas are used as the radiating sources. The surrounding plasma is assumed to be a weakly ionized gas type and is treated either as a lossy, cold (incompressible) plasma or as a lossy, hot (compressible) plasma. Two rather different physical models and two different sets of basic equations are adapted for these two kinds of plasmas. In order to conduct an extensive and accurate experimental study on the interaction of an antenna with a hot plasma, a large volume of stable, high-density plasma was produced. The spherical and cylindrical antennas were used as the radiating sources and they were fed through a large ground plane. The radiation fields from both antennas and the input impedance of the cylindrical antenna were measured as a function of the plasma parameters. Dissert. Abstr.

N71-32648# Texas Univ., Austin. Radio Astronomy Observatory.
THE 16 ELEMENT CROSSED DIPOLE ARRAY
F. A. Bozyan 2 Jul. 1971 14 p
(Rept-30) Avail: NTIS

Progress in development of a 16-element crossed dipole array for observations of Jupiter is reported. The array is designed with limited remote steering capabilities that will provide useful gain even when the planet is at low declination. Two senses of steering are applied: (1) array phasing; and (2) remote selection of dipole set and phasing. A computer program calculates the gain for each steering. The electrical and physical properties of the array are described and illustrated, and computed antenna feed and gain patterns are presented. A.C.R.

N71-32664# Avco Corp., Wilmington, Mass. Systems Div.
BREAKDOWN IN THE NEAR FIELD OF REENTRY VEHICLE ANTENNA Annual Technical Report, 1 Nov. 1969 – 31 Oct. 1970
Ronald L. Fante and Jerrold M. Yos 1 Apr. 1971 12 p refs
(Contract F19628-69-C-0121)
(AD-723655; AVSD-0225-71-CR; AFCRL-71-0228; Rept-1) Avail: NTIS CSCL 17/2

The research included: (a) a detailed study of the near field of aperture antennas and the influence of the near field upon breakdown, (b) improvements and extensions of a computer program developed to compute the admittance, isolation, and radiation pattern of a slot in a perfectly conducting plasma-coated ground plane, (c) analysis of experiments measuring breakdown power levels of high temperature air and nitrogen. Author (GRA)

N71-32684# Joint Publications Research Service, Washington, D.C.
RADIO CONTROL
L. S. Gutkin, ed. et al 10 Aug. 1971 269 p refs Transl. into ENGLISH from the book 'Radioupravleniye, no. 5' Moscow, 1970 324 p
(JPRS-53789) Avail: NTIS

Radio control of the motions of aerospace vehicles of various types and purposes (missiles, spacecraft, aircraft) is examined. Chief attention is focused on the principles and methods of radio control. Methods of analysis and synthesis of the corresponding systems, closed control loops, and correction control systems are described and the requirements on the makeup of radio engineering installations and systems and their characteristics are formulated. The basic radio engineering tools, which determine the quality of radio control, their principles of operation, characteristics, and potentials are discussed. Author

N71-32697*# Westinghouse Electric Corp., Baltimore, Md. Aerospace and Electronic Systems Div.
TESTING OF APOLLO BLACK AND WHITE TELEVISION CAMERAS Final Report
L. L. Niemyer [1971] 14 p
(Contract NAS9-10997)
(NASA-CR-115105; WEC-57660) Avail: NTIS CSCL 17B

Tests were conducted to determine the condition and performance of Apollo black and white television cameras after an extended period of shelf storage. The cameras were tested for signal to noise ratio resolution as a function of light level and frame rate, shades of grey, linearity, and shading. In addition, the cameras were examined for blemishes, extraneous noise, and the condition of tube potting. The data were compared with acceptance data at the time of manufacture. Results indicate that the camera's performance did not degraded because of long storage. E.H.W.

N71-32713 George Washington Univ., Washington, D.C.
OPTIMUM RANDOM SEARCH PROCEDURES FOR DETECTING EVASIVE TARGETS
Wayne James Fischer (Ph.D. Thesis) 1970 157 p

Avail: Univ. Microfilms Order No. 70-17233

The optimization of the search motion of a searcher looking for an evasive target was investigated. Certain additions and modifications to the basic equations of search theory as developed by Koopman were examined. The effect that variations in search parameters have on the efficiency of the search coverage and on the amount of information concerning the searcher's motion given to the target were considered in determining the optimum search procedure. Consideration was also given to the selection of the direction of search motion based on the previous direction of motion as a possible technique for increasing search effectiveness. The effect on the search equations of time dependent variations in the probability of detection as a function of range was also considered. These considerations were than applied to a typical submarine detection problem. Equations for the optimum search speed and the optimum submarine speed were developed based on max-min theory. Typical detection ranges for submarine detection by sonar were calculated and the probability of detecting the target was determined. Dissert. Abstr.

N71-32717 Maryland Univ., College Park.
SUPER BANDWIDTH UTILIZATION IN AN ANTI-CLUTTER RADAR
Omar Joslin Jacomini (Ph.D. Thesis) 1969 205 p
Avail: Univ. Microfilms Order No. 70-15373

The methods for utilizing very wide bandwidth radar signals for rejection of clutter without requiring the use of the very high capacity storage and display equipment normally associated with wide bandwidths are studied. Two complementary techniques which are called bandwidth removal and bandwidth control are examined. The bandwidth removal technique is one which attempts to convert wide bandwidth receive signals into narrower bandwidth signals for storage and display purposes. This technique was investigated for systems using both coherent and noncoherent integration of multiple pulses. The bandwidth control technique is one which seeks to use a time varying bandwidth in the receiver which changes as a function of the range to the target. In regions where clutter is strong, full bandwidth is employed. Dissert. Abstr.

N71-32758*# Environmental Science Services Administration, Rockville, Md.
RADAR DATA SAMPLE PRODUCTS
In its BOMEX Bull., No. 7 Jul. 1970 p 19-24 (See N71-32755 19-34)
Avail: NTIS CSCL 17I

Descriptions are presented of the processes used in making qualitative and quantitative analyses of the BOMEX weather radar data collected by aircraft and land-based radars. D.L.G.

N71-32779 National Lending Library for Science and Technology, Boston Spa (England).
BANDWIDTH REDUCTION IN PULSE CODE MODULATION TELEVISION TRANSMISSION BY THE REDUCTION OF THE SAMPLING FREQUENCY
U. Messerschmid 17 Nov. 1970 18 p refs Transl. into ENGLISH from NTZ-Nachr. Z. (Brunswick), v. 22, no. 9 p 515-521 (NLL-PORS-Trans-2684-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

A summary is given of some important results obtained and tendencies observable in previous investigations into the reduction of redundancy, in order to show how the new investigations fit into the broader pattern. A method for economising bandwidth in the PCM transmission of television signals is described. Author

N71-32780# IIT Research Inst., Annapolis, Md.
A SIMPLIFIED METHOD FOR CALCULATING THE BOUNDS ON THE EMISSION SPECTRA OF CHIRP RADARS
P. Newhouse Feb. 1971 58 p refs
(Contract F19628-70-C-0291)
(AD-724184; ESD-TR-70-273) Avail: NTIS CSCL 17/9

A mathematical method that permits rapid hand calculation of the approximate bounds on the emission spectra of chirp radars is derived, and its application to electromagnetic compatibility (EMC) analysis is explained. The pulse envelope is assumed to be trapezoidal; either a symmetrical or asymmetrical pulse can be accommodated. The accuracy attained easily meets the requirements for most EMC analyses. The theoretical difference between the exact and the approximated bound is less than one dB for the center region and skirts of the spectrum. In the narrow frequency interval where the chirp spectrum falls very rapidly, the error is usually less than six dB. The approach used in deriving the model involved the use of an asymptotic expansion instead of the usual Fresnel integrals to describe the skirts of the voltage-density spectrum. Author (GRA)

N71-32788# Academy of Sciences (USSR), Moscow. Inst. for Space Research.
PECULIARITIES OF RADIOWAVE PROPAGATION IN VENUS ATMOSPHERE
N. N. Kroupenio and K. M. Rykunova 1971 22 p refs
(D-81) Avail: NTIS

On the basis of measured temperature, pressure, and chemical composition of the Venus atmosphere by automatic interplanetary station "Venera-4", "Venera-5", "Venera-6", and "Venera-7", refraction and attentuation for cm and dm radioband was calculated. The results of calculation were compared with measurement data of radiowave attenuation from "Mariner-5 radio-occultation experiment. Author (ESRO)

08 COMPUTERS

Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics

N71-31634# RAND Corp., Santa Monica, Calif.
SECURITY OF COMPUTERIZED INFORMATION SYSTEMS
Rein Turn and Harold E. Peterson *In* Kentucky Univ. Proc. of 1970 Carnahan Conf. on Electron. Crime Countermeas. Apr. 1970 p 82-88 refs (See N71-31628 19-07)
Avail: NTIS

The vulnerabilities of remotely accessible computerized information systems to electronic crime and the penetration of the information system for illicit copying, altering or destruction of selected information are discussed. A condensed survey of the probable threats and applicable countermeasures is presented. A particular emphasis is placed on the use of cryptographic techniques for protecting information in the communication lines and in computer files. Author

N71-31635# Radio Corp. of America, Camden, N.J. Advanced Technology Labs.
AUTOMATIC SPEAKER IDENTIFICATION AND VERIFICATION
M. B. Herscher, T. B. Martin, and W. F. Meeker *In* Kentucky Univ. Proc. of 1970 Carnahan Conf. on Electron. Crime Countermeas. Apr. 1970 p 89-94 refs (See N71-31628 19-07)
Avail: NTIS

A technique for automatically identifying or verifying an individual from his voice characteristics is described. The technique utilizes a combined hardware/software system, although the entire

operation can be implemented completely in hardware. The voice identification/verification system is capable of operating in real time and has the important advantage of not requiring known text to be employed either for generating speaker reference data or testing unknown samples. Speaker recognition can be achieved from ordinary continuous speech. This advantage permits the monitoring and identification (or verification) of uncooperative speakers with no human intervention required to segment speech elements for comparison with stored reference segments. Operating in more conventional modes, this technique also is capable of verifying individuals peaking a known text or code for credit-card ownership verification or satisfying privacy requirements for time-shared computer systems. Voice verification can be achieved remotely where the individual is located or through a telephone interconnection to a time-shared central processor. Author

N71-31636# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
AUTOMATIC VEHICLE IDENTIFICATON: A UNIQUE APPROACH
Robert A. Hayman *In* Kentucky Univ. Proc. of 1970 Carnahan Conf. on Electron. Crime Countermeas. Apr. 1970 p 95–97 (See N71-31628 19-07)
Avail: NTIS

The recognition and identification of motor vehicles in a reliable and expedient manner is discussed. A unique approach, based on advanced infrared techniques, to automatically identify vehicles is considered in terms of overall system requirements. The conceptual system could remain operational over the environmental conditions under which motor vehicles may be required to operate. This system concept requires no active elements on the vehicle and may be considered almost tamper-proof. A variety of operational modes, both covert and overt forms of detection and identification, could be utilized by law enforcement agencies. Author

N71-31647# Kentucky Univ., Lexington.
COMPUTER AIDED FINGERPRINT IDENTIFICATION
Anthony Paolantonio *In its* Proc. of 1970 Carnahan Conf. on Electron. Crime Countermeas. Apr. 1970 p 185–197 refs (See N71-31628 19-07)
Avail: NTIS

An automated system for high speed identification of human fingerprints is discussed. A binary digital matric, prepared from the raw fingerprint impression on a standard police file card, is used as a reference for a computer search process. The only evidence needed for identification in this system is the suspect's fingerprint, which may be a flat or rolled impression or a damaged, incomplete latent print lifted from the scene of the crime. It is shown that the total man-machine cycle time can be accomplished in less than one hour. Author

N71-31648# Syracuse Univ., N.Y.
A COMPUTER SYSTEM SUITABLE FOR CRIMINAL IDENTIFICATIONS
Tse-Yun Feng *In* Kentucky Univ. Proc. of 1970 Carnahan Conf. on Electron. Crime Countermeas. Apr. 1970 p 198–206 ref (See N71-31628 19-07)
Avail: NTIS

A system suitable for high-speed processing of non-numerical information to aid in criminal identification is described. The logic design of the proposed system is discussed along with the various search and retrieval operations. Several design approaches were taken to implement the system and all showed a tremendous cost reduction as compared with a system using a conventional associative memory. D.L.G.

N71-31662# Deutsche Forschungs- und Versuchsanstalt fuer Luft und Raumfahrt, Brunswick (West Germany). Abteilung Flugmechanik der Luftfahrzeuge.
A COMPUTATION PROGRAM FOR A HYBRID COMPUTER FOR THE DETERMINATION OF TRANSIENT DEVELOPMENTS OF EULER ANGLES BY MEANS OF TWO EULER ANGLE SEQUENCES [EIN RECHENPROGRAMM FUER EINEN HYBRIDRECHNER ZUR BESTIMMUNG ZEITLICHER VERLAEUFE DER EULERWINKEL UNTER BENUTZUNG VON ZWEI EULERWINKELFOLGEN]
Ernst Mewes and Ruthard Koehler Feb. 1971 27 p refs In GERMAN; ENGLISH summary
(DLR-FB-71-19) Avail: NTIS; DFVLR Porz: 8.50 DM

The locations of a body in space which lead to a degeneration of the Euler angles depend on the angle sequence. The computer program discussed allows the calculation of the Euler angles in every position of the body. As soon as the Euler angles of a sequence approach the vicinity of the location in which they degenerate, the computer program goes to the determination of the Euler angles of another sequence. Author (ESRO)

N71-31667# Standard Electrik Lorenz A. G., Stuttgart (West Germany). Abteilung Weitverkehr und Navigation.
PROJECT HELIOS: STORAGE OF SHOCK MODE DATA [PROJEKT HELIOS: SPEICHER FUER SCHOCKMESSUNGEN]
W. Hellmer and D. Pabst Bad Godesberg, West Ger. Bundesmin. fuer Bildung und Wiss. Mar. 1971 35 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Bildung und Wiss.
(BMBW-FB-W-71-14) Avail: NTIS; ZLDI Munich: 7.40 DM

Following a discussion of the requirements imposed by the experiments and a comparison of memory types, realizable memory organizations are described and evaluated. The feasibility of shock data storage is proven in a concept proposal. A central-memory version, comprizing a 500-kbit-RAM ferrite core memory, is proposed for shock data storage. An encoder continuously reads the data into the control memory (sequential addressing) in formats suitable for transmission (time division multiplex). Author (ESRO)

N71-31697# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung Instrumentierung und Anthropotechnik.
AN INSTALLATION FOR ANALOG SIGNAL PROCESSING WITH COMPUTER COMPONENTS [EINE ANLAGE ZUR ANALOGSIGNAL-VERARBEITUNG MIT RECHNERKOMPONENTEN]
Eckhart Zietlow Mar. 1971 40 p refs In GERMAN; ENGLISH summary
(DLR-MITT-71-06) Avail: NTIS; DFVLR Porz: 10.50 DM

Analog computer modules allow simple arithmetic computations. They can be used to build powerful and flexible systems which can be adapted to varying tasks. However, the increasing number of applications raises the question of the effectiveness of such systems in comparison with analog computers of equivalent performance. Some hereto related aspects are discussed on the basis of a relatively large system built from modules. Practical experience has shown that with a well-designed concept a high degree of performance can be achieved with such systems at moderate costs. Author (ESRO)

N71-31780# Cologne Univ. (West Germany). Inst. fuer Geophysik und Meteorologie.
THE DEVELOPMENT OF A COMPUTER PROGRAM SYSTEM USING ASSEMBLING PRINCIPLES FOR APPLICATION IN GEOPHYSICAL RESEARCH [ZUR ENTWICKLUNG EINES SYSTEMS VON RECHENPROGRAMMEN NACH DEM BAUKASTENPRINZIP FUER DIE ANWENDUNG IN DER GEOPHYSIKALISCHEN FORSCHUNG]
H. Zschoerner Mar. 1970 31 p ref In GERMAN *Its* Mitt. No. 12

(MITT-12) Avail: NTIS

The backgrounds of the development of a computer program system based on an assembling principle, primarily for geophysical data processing, are described. ESRO

N71-31886# Technische Hochschule, Darmstadt (West Germany). Inst. fuer Flugtechnik.

DIGITAL SIMULATION OF RANDOM PERTURBATION VARIABLES [DIGITALE SIMULATION REGELLOSER STOERGROESSEN]

M. Zindel *In* DGLR Turbulence Model at Low Altitudes and Flight in a Turbulent Atmosphere Dec. 1970 p 55–86 In GERMAN (See N71-31882 19-02)

Avail: NTIS; ZLDI Munich: 34 DM

Basic backgrounds of the digital generation of stationary random number series with given statistical properties are described. The roll of statistical prediction is sketched in this connection. The possibility of a vectorial generalization is printed out. A few examples are given. ESRO

N71-31990# Naval Ordnance Lab., White Oak, Md.

COMPARISON OF METHODS USED FOR SHOCK AND FOURIER SPECTRA COMPUTATIONS

Robert S. Reed, Jr. 24 Nov. 1970 162 p refs

(AD-723536; NOLTR-70-243) Avail: NTIS CSCL 12/1

Analog and digital techniques used in the computation of the shock and Fourier spectra are presented and compared on the bases of speed, accuracy and ease of usage. Analog computers with active and passive elements are considered, and it is concluded that active RC networks make accurate and simple-to-use computers for the analog determination of spectra. The digital techniques studied included the impulse-invariant Fast Fourier transform, z-transform, and the OHara method which uses a parabolic interpolation formula. Author (GRA)

N71-32015# Joint Publications Research Service, Washington, D.C.

CONCERNING A PROMISING TREND IN COMPUTER TECHNOLOGY

V. P. Belyavskiy et al *In its* Visual, Memory and Bionic Models' Role Analyzed 21 Jul. 1971 p 24–32 refs (See N71-32012 19-04)

Avail: NTIS

The structure and functions of the human central nervous system as a basis for the development of more reliable computers and information systems are discussed. The application of biological bionics, theoretical bionics, and engineering bionics in the development of cybernetic systems is proposed. P.N.F.

N71-32118# Oak Ridge National Lab., Tenn.

EDITOR: A PROCESSING CODE FOR ENDF/B FORMAT DATA

C. L. Thompson, J. R. Stockton, L. M. Petrie, R. Q. Wright, and S. K. Penny 16 Feb. 1971 33 p

(Contract W-7405-eng-26)

(ORNL-TM-3266; ENDF-142) Avail: NTIS

EDITOR is a FORTRAN IV computer code designed to print, in readable form, the contents of ENDF/B format nuclear cross-section data tapes. In addition, EDITOR allows copying, altering mode, merging, punching and otherwise manipulating the data which appears on one or more ENDF tapes. Author (NSA)

N71-32170*# National Aeronautics and Space Administration, Washington, D.C.

AN A PRIORI ESTIMATE OF THE QUALITY OF A DATA COMPRESSION SYSTEM ACCORDING TO THE STATISTICAL CHARACTERISTICS OF THE UTILIZED SENSORS [APRIORNAYA OSTENKA KACHESTVA SISTEMY SZHATY DANNYKH PO STATISTICHESKIM KHARAKERTERISTIKA ISPOLZUYEMYKH DATCHIKOV]

Yu. K. Khaodarv et al Jul. 1971 9 p ref Transl. into ENGLISH of Acad. of Sci. (USSR), Moscow, Inst. for Space Res. report Pr-25

(NASA-TT-F-13792; Pr-25) Avail: NTIS CSCL 05B

The possibility is shown and a method is presented for an apriori evaluation of the real compression coefficient of a spacecraft's data processing system. The mutual correlation of transmitter (sensor) signals is presumed to be unknown. In order to arrive at such estimates, average values of sensor activity of the telemetry system are utilized. Author

N71-32188*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

FITLOS: A FORTRAN PROGRAM FOR FITTING LOW ORDER POLYNOMIAL SPLINES BY THE METHOD OF LEAST SQUARES

Patricia J. Smith Washington Aug. 1971 94 p refs

(NASA-TN-D-6401; E-5292) Avail: NTIS CSCL 09B

FITLOS is a FORTRAN IV program to fit polynomial splines of degrees two and three. It combines some of the advantages of the method of least squares with the segmented curve of the theory of splines. FITLOS divides a set of data points into subsets and fits a polynomial of degree two or three on each subset by the method of least squares. The total curve is made smooth by making the polynomials on adjacent subsets and their first derivatives equal at the break point between the segments. For third-degree polynomials, the second derivatives are also made equal. These constraints are imposed by the method of Langrangian multipliers. The material presented describes the mathematical analysis of the least squares polynomial spline fit, gives complete documentation of program FITLOS, and serves as a user's guide for FITLOS. The program listing, flow charts, and example problems are included. Author

N71-32216# California Univ., Livermore. Lawrence Radiation Lab.

ENGINEERING VIEW OF THE LRL OCTOPUS COMPUTER NETWORK

David L. Pehrson 17 Nov. 1970 32 p Sponsored by AEC

(UCID-15754) Avail: NTIS

The evolution of Lawrence Radiation Laboratory's (LRL) time sharing system, the OCTOPUS Computer Network, is described. A complete description of the background is provided, with emphasis on the features peculiar to LRL computing needs. The design of the File Transport Network, the Teletype Network, and other remote I/O is discussed, and implementation of these designs is described. New efforts are considered, and an overview of the future computing system is presented. Daily use of the OCTOPUS System after initial development has produced stability requirements. The resultant multinetwork approach provides for continuity, flexibility, and longevity unachievable with any single-computer system. Author

N71-32281# RAND Corp., Santa Monica, Calif.

INTERACTIVE SIMULATION OF CONTINUOUS SYSTEMS: PROGRESS AND PROSPECTS

G. A. Bekey and E. C. De Land Jan. 1971 21 p refs

(Contract GM-15896)

(P-4503) Avail: NTIS

The background of present-day continuous systems simulation techniques is reviewed, with emphasis on interactive, graphic-oriented systems. The state-of-the-art is discussed, particularly as it concerns user convenience, interactive features, the use of block diagram descriptions, and graphic displays. BIOMOD, a

system recently developed for simulation of biological systems, is used as an example. Limitations of present-day systems and prospects for near-future development are discussed. Author

N71-32330# Naval Research Lab., Washington, D.C.
SIMULATION OF AADC SYSTEM OPERATION WITH AN E-2-B PROGRAM WORKLOAD Interim Report
William R. Smith 22 Apr. 1971 56 p refs
(AD-723521; NRL-7259) Avail: NTIS CSCL 9/2

Modeling and simulation of the proposed Naval Advanced Avionic Digital Computer (AADC) has been undertaken in order to study system performance and arrive at optimum hardware configurations. Author (GRA)

N71-32345# Union Carbide Corp., Oak Ridge, Tenn.
PREPARATION OF CONTROL TAPE FOR AN R-THETA INSPECTION MACHINE
C. W. Wilson and W. R. Hensley 9 Apr. 1971 56 p
(Contract W-7405-ENG-26)
(Y-1725) Avail: NTIS

An APT postprocessor has been written that is suitable for producing control tape for a continuous-path, numerically controlled inspection machine. In addition, geometric construction routines have been written that relate to APT's TABCYL surfaces. Author

N71-32346*# National Aeronautics and Space Administration, Washington, D.C.
STATISTICAL ANALYSIS OF DATA OBTAINED FROM LONG-RANGE SPACECRAFT [STATISTICHESKIY ANALIZ DANNYKH POLUCHENNYKH S DALNYKH KOSMICHESKIKH APPARATOV]
Yu. K. Khodarev et al Jul. 1971 14 p refs Transl. into ENGLISH of Acad. of Sci. USSR, Moscow. Inst. for Space Res. report Pr-26, 1970
(NASA-TT-F-13791; Pr-26) Avail: NTIS CSCL 05B

A simulation is performed for onboard systems of data compression utilizing the zero order for all the channels entering in the telemetric frame on the basis of data obtained from scientific experiments of Soviet long range spacecrafts. The method of introduction into the compressed frame of the auxiliary (overhead) information is utilized. The statistical analysis and the calculation of the coefficient of compression of system's data are performed by using a probability distribution of the number of active channels in the frames and by channel activity. The systems of data compression were simulated on a universal computer. Author

N71-32380*# Stanford Research Inst., Menlo Park, Calif.
A TECHNIQUE FOR AUTOMATIC REAL TIME SCORING OF SEVERAL SIMULTANEOUS SLEEP ELECTROENCEPHALOGRAMS
R. W. Becker, J. S. Lukas, M. E. Dobbs, and F. Poza Washington NASA Aug. 1971 30 p refs
(Contract NAS1-9286)
(NASA-CR-1840) Avail: NTIS CSCL 06E

During an ongoing program to assess the effect of aircraft noise on human sleep, an automatic technique for analyzing and scoring the electroencephalographic (EEG) sleep records was developed. Extensive EEG records are processed since groups of four subjects each are tested nightly. Included in the system are electronic devices for filtering and processing the electrophysiological signals necessary to discriminate between stages of sleep. A small computer is used to score and analyze the processed signals. The technique is of value since a great deal of technical manpower is required for visual scoring and analysis of such an experiment. An additional, and possibly more critical, problem involves the imperfect reliability of visual analysis of EEGs: inter-scorer reliabilities range between 0.80 and 0.95, even among expert scorers. Author

N71-32459*# Maryland Univ., College Park. Computer Science Center.
AN OVERVIEW OF ASSOCIATIVE OR CONTENT ADDRESSABLE MEMORY SYSTEMS AND A KWIC INDEX TO THE LITERATURE
Jack Minker Jun. 1971 137 p refs
(Grant NGL-21-002-008)
(NASA-CR-119779; TR-157) Avail: NTIS CSCL 09B

This bibliography of associative or content-addressable memory systems covers the literature from approximately 1956 through 1970. A brief overview of the literature referencing pertinent articles is provided. The overview is current to approximately 1969 when it was written. In addition, the bibliography is presented as a Key Word In Context Index (KWIC). Areas discussed in the overview are applications, hardware implementation, computer organizations with associative memories, and software aspects. Author

N71-32469# California Univ., Livermore. Lawrence Radiation Lab.
NUMERICAL IMAGE RESTORATION
M. P. Ekstrom and O. L. Rater 10 Mar. 1971 5 p refs Presented at the IEEE Region 6th Conf., Sacramento, Calif., 11 May 1971 Sponsored by AEC
(UCRL-73080; Conf-710506-1) Avail: NTIS

A numerical method for the restoration of planar images recorded on a background of random noise is presented. The restoration is performed by a discrete, linear filtering operation designed to a mean-square error criteria. A solution for the point spread response of the processor using the finite Fourier transform is given, as are several examples of application. Author

N71-32483# University of Southern Calif., Los Angeles. Dept. of Electrical Engineering and Medicine.
STATISTICAL ANALYSIS, A COMPUTER ORIENTED APPROACH. 4-2: THE ANALYSIS OF VARIANCE, USAGE OF COMPUTER PROGRAMS
S. P. Azen and A. A. Afifi (Calif. Univ., Los Angeles) May 1971 68 p refs
(Grant GM-16197-03)
(TR-71-18) Avail: NTIS

The nature of a standard packaged analysis of variance computer program is discussed. Many packages include only one anova program which computes the anova table for a factorial design. The factorial design is defined, programs which do and do not permit relicates are distinguished, and how a program of the latter category may be used to analyze replicated factorial designs is explained. Factorial programs can also be used to analyze special designs such as the randomized blocks, replicated randomized blocks, and nested designs. Methods of utilizing a standard factorial program for analyzing these designs as well as the split-plot and Latin square are presented. Author

N71-32494*# Maryland Univ., College Park. Computer Science Center.
GRAAL: A GRAPH ALGORITHMIC LANGUAGE
Werner C. Rheinboldt, Victor R. Basili, and Charles K. Mesztenyi Aug. 1971 12 p ref Presented at the 2d IBM Res. Symp. on Sparce Matrices and Their Appl., 9-10 Sep. 1971 Submitted for publication
(Grants NGL-21-002-008; NSF GJ-1067)
(NASA-CR-119778; TR-165) Avail: NTIS CSCL 09B

A FORTRAN-based version of the language, called FGRAAL is discussed. A brief review of the set theoretical foundation of the basic language GRAAL is given. Then the FGRAAL grammar is summarized, followed by five examples of FGRAAL subroutines. One of these represents a new algorithm for finding strong components of a digraph. Author

N71-32505*# California Univ., Los Angeles. School of Engineering and Applied Science.
CONCATENATION OF CONVOLUTIONAL AND BLOCK CODES Final Report
A. J. Viterbi, J. P. Odenwalder, W. J. Rosenberg, and G. F. Zeoli 10 Jun. 1971 196 p refs
(Contract NAS2-5478)
(NASA-CR-114358) Avail: NTIS CSCL 09B

Fundamental properties of optimal short constraint-length convoltional codes and the corresponding maximum likelihood decoders are discussed. The determination of a optimum rate 1/2 and 1/3 convoltional code and the effect of quantization and memory truncation are included. Various approaches to concaternation of block and convolutional codes using short constraint length convolutional inner codes and long block length Reed-Solomon outer codes are presented. Structural results involving catastrophic convolutional codes, finite-state representation, and consecutive zeros in convolutional codewords are summarized. Author

N71-32543 Yale Univ., New Haven, Conn.
DATA MANAGEMENT ABOARD SCIENTIFIC SPACECRAFT
Hyung Kun Kim (Ph.D. Thesis) 1969 262 p
Avail: Univ. Microfilms Order No. 70-16286

As a direct data redundancy removal algorithm suitable for onboard spacecraft applications, bit-plane encoding (BPE) is investigated together with other well known aperture methods. Since each row, called bit plane, of a block of digitized data, which is stored in a data memory in column direction, is encoded one at a time in the basic BPE algorithm, attempts are made to estimate how much information or entropy is contained in the bit planes. The analysis is made for a first-order Markov process. Bit planes are shown to higher-order binary Markov sources and approximations are made to estimate the entropies of bit planes. In general, if the data are very active or if the prediction probability is low, BPE will give higher bit compression ratio. Some practical test data are also used to supplement the analysis by the idealized Markov data model. Finally, several alternative designs of the bit-plane encoders are considered and controlling the problem of a buffer memory that includes BPE is discussed. Dissert. Abstr.

N71-32600# Australian National Univ., Canberra. Research School of Physical Sciences.
COMPUTER REDUCTION OF COMPLEX SPECTRA
T. R. Ophel [1970] 81 p refs
(ANU-P-487(2)) Avail: AEC Depository Libraries

The problems of on-line and off-line computer analysis of complex spectra, with particular reference to particle and gamma ray spectra, are summarized. Details are given of an integrated set of on-line and off-line analysis programs for use with the IBM 1800, and of a universal program for the S360/50, INCRED, which incorporates all of the features of the 1800 programs and employs both linear and nonlinear fitting techniques. The programs are intended to perform all the basic reduction functions usually required and are structured so that modifications or additions to meet particular user requirements are readily made. The final section discusses line shape fitting of gamma ray spectra obtained with NaI and Ge(Li) detectors in the context of programs intended for use on the IBM 1800 and the S360/50. Author (NSA)

N71-32698*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md. Information Processing Div.
THE SSS PAPER TAPE PUNCH AND VERIFY PROGRAM
John T. Jackson and William H. Hopkins Jul. 1971 16 p Submitted for publication
(NASA-TM-X-65866; I-565-71-322) Avail: NTIS CSCL 09B

The SSS paper tape reader/punch is an input/output devide for the CDC 3200 computer system. It punches paper tape for SSS flight programs and does a bit-for-bit verification of the paper taped punched. The program may also be used in two tape drives, and a card reader. E.H.W.

N71-32714# National Bureau of Standards, Washington, D.C. Systems Development Div.
A PRELIMINARY DESIGN OF A DATA RETRIEVAL LANGUAGE TO HANDLE A GENERALIZED DATA BASE: DRL
Elizabeth Fong Jul. 1971 26 p refs
(NBS-TN-590) Avail: SOD $0.35

The DRL system consists of a set of primitives utilizing both compile time macros and run time subroutines. These primitives are embedded in a high level, procedure oriented programming language (FORTRAN in this case). These primitives form a base upon which a class of languages can be defined. The language includes a data description language which can describe fixed-length hierarchical data structures, and DRL includes a data retrieval statement whereby a user can retrieve data by specifying conditions on to the data value. DRL is implemented as a preprocessor to FORTRAN V on the UNIVAC 1108, under EXEC II Operating system. Keywords act as triggers and are replaced by blocks of FORTRAN code. Author

N71-32759*# Environmental Science Services Administration, Rockville, Md.
STATUS OF DATA PROCESSING AND REDUCTION (15 JUNE 1970)
In its BOMEX Bull., No. 7 Jul. 1970 p 25-34 (See N71-32755 19-34)
Avail: NTIS CSCL 09B

Status summaries are presented for BOMEX data processing and reduction that include: (1) fixed-ship computer data processing, (2) manual rawinsonde data reduction, (3) aircraft data reduction, (4) background weather analysis, (5) turbulent flux analysis, (6) radiation analysis, (7) cloud data reduction, (8) radar data reduction, and (9) satellite data reduction. D.L.G.

N71-32762*# National Oceanic and Atmospheric Administration, Rockville, Md.
STATUS OF BASIC DATA REDUCTION AND PROCESSING
In its BOMEX Bull., No. 8 Oct. 1970 p 37-40 (See N71-32760 19-34)
Avail: NTIS CSCL 05B

The BOMEX data reduction and processing status is reported, including fixed ship computer data, manual rawinsonde data, background weather analysis, dropsonde data, cloud photographs, radiation analysis, radar data, and turbulent flux analysis. The salinity-temperature-depth sensor data and boundary layer instrument package data are also considered. J.A.M.

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N71-31868# Compagnie Francaise Thomson Houston-Hotchkiss Brandt, Paris.
STUDY OF THE COMPUTERIZED INTERCONNECTION OF PRINTED OR INTEGRATED CIRCUITS OPERATING IN MAN-MACHINE DIALOG MODE [ETUDE CONCERNANT

L'INTERCONNEXION PROGRAMMEE DE CIRCUITS IMPRIMES OU INTEGRES (LSI) EN MODE DE TRAVAIL AVEC DIALOGUE HOMME-MACHINE
F. Peze May 1970 43 p In FRENCH
(Contract DGRST-69-01-603-00-212-75-01)
Avail: NTIS

A program has been developed for designers of integrated circuit boards. A Lee algorithm is used for a semi-automatic drawing of the connections between the different components on the board. A dialog procedure between the operator and the computer is provided for. ESRO

N71-31695# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung Instrumentierung und Anthropotechnik.
PARAVISUAL INDICATOR FOR ELECTRONIC DISPLAYS [PARAVISUELLE ANZEIGE FUER ELECTRONISCHE DISPLAYS]
Josef Thomas Mar. 1971 34 p refs In GERMAN; ENGLISH summary
(DLR-FB-71-27) Avail: NTIS; DFVLR Porz: 10 DM

The development of electronic aircraft displays facilitates new implementation methods for paravisual indication which could be more efficient than those used in the past. A method was developed for the electronic display of a checkerboard pattern moving in two axes on the screen of a cathode ray tube. The technique of digital symbol generation is described and some possible applications for this paravisual indication in aircraft are shown. Author (ESRO)

N71-31696# Compagnie Francaise Thomson Houston-Hotchkiss Brandt, Paris. Lab. Magnetisme.
REPORT OF A SUPPORTED STUDY ON MICROWAVE MICROELECTRONICS WITH FERRITE SUBSTRATES [COMPTE RENDU DES ETUDES AVEC FOND DE PARTICIPATION SUR LA MICROELECTRONIQUE HYPERFREQUENCE A SUBSTRAT FERRITE]
M. Blanc, M. Dusson, and M. Guidevaux Jan. 1971 96 p In FRENCH
Avail: NTIS

Research and development work has been performed on a garner filter operating in the C-band for use in onboard responders. Different characteristics of the filter are presented in the form of curves. A microwave circulator providing a differential phase shift of 180 with losses smaller than 1 db is described. Finally multichannel circulators operating in the C, X, and KU bands are discussed. ESRO

N71-31707# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.
INFINITE ARRAYS OF SUB-ARRAY ANTENNAS
Wasyl Wasylkiwskyj and Walter K. Kahn Sep. 1970 28 p refs
(AD-722488; P-679; IDA/HQ-70-11786) Avail: NTIS CSCL 9/5

A unified network approach to the analysis of infinite regular arrays of antennas is presented. The periodically repeated constituent of the array is itself regarded as a sub-array, the sub-array taking a variety of particular forms. With the appropriate choice of sub-array, the same formulation yields as special cases the unform linear, planar, and cylindrical arrays as well as such arrays comprising several heterogeneous elements or multimode elementary antennas. Author (GRA)

N71-31710# Naval Medical Research Inst., Bethesda, Md.
VERSATILE AUDIO MIXING AND DISTRIBUTION AMPLIFIERS Medical Research Interim Report
Joseph A. Diachenko and Benjamin Valjoen 10 Oct. 1970 15 p
(AD-723810; NAVMED-M4306.02-2040-1) Avail: NTIS CSCL 9/5

Past research projects in the Behavioral Sciences Department leaned heavily upon the use of a complex, audio equipment array interposed between human subjects and researchers. Requirements to distribute audio information from a single source to several destinations, and the need to mix serveral audio signals into a single channel could not be met by reasonably priced commercial equipment. Therefore, a distribution amplifier and a mixer amplifier were specially designed and manufactured from commonly available components. Within the human voice range these amplifiers worked well with good fidelity and long term reliability, and were found to be versatile instruments for handling a wide range of audio combinations. Author (GRA)

N71-31714# Army Electronics Command, Fort Monmouth, N.J.
DEVELOPMENT OF SCREENABLE HIGH DIELECTRIC CONSTANT CERAMIC GLASS DIELECTRICS
William A. Vitriol Mar. 1971 31 p refs
(AD-723404; ECOM-3405) Avail: NTIS CSCL 9/1

The report describes the technique and procedures used to develop low firing temperature screened in place dielectric (barium titanate-glass frit) paste for use as thick film capacitors in microcircuits. This BaTiO3 - glass composition was found to possess effective dielectric constant values over K-1000 and loss tangent less than 2% when screen-printed on metallized alumina ceramic substrate and fired to 1000C. These BaTiO3 - glass systems have also been found suitable for processing bulk ceramic specimens having dielectric constant values up to K-1900 and low dielectric loss. Electrical data - dielectric constant, loss tangent with temperature and temperature coefficient of dielectric constant are reported. Electron micrographs and physical properties of glass frit are also included. Author (GRA)

N71-31742# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
GaAs JUNCTION FIELD EFFECT TRANSISTOR RADIATION STUDY Final Report, May 1970 - Feb. 1971
Rainer Zuleeg and Allen F. Behle Mar. 1971 41 p refs
(Contract F19628-70-C-0197)
(AD-723303; AFCRL-71-0153) Avail: NTIS CSCL 9/1

Active and passive GaAs devices, fabricated from epitaxial N-type material in a doping range from 10 to the 16th power to 10 to the 17th power/cu cm, were exposed to a fast neutron fluence (E > 10 keV) of 2 x 10 to the 15th power n/sq cm2. The experimental GaAs J-FETs have a nominal channel length of 5 microns, i.e., maximum frequency of oscillation between 4 and 6 GHz. In reasonable accord with predictions experimental GaAs J-FETs with a channel doping concentration of 5 x 10 to the 16th power/cu cm measured a 20% degradation of transconductance and pinch-off voltage when exposed to a fluence of 2 x 10 to the 15th power neutrons/sq cm. Devices with channel doping concentrations of 10 to the 17th power/cu cm are predicted to survive fluences of about 10 to the 16th power neutrons/sq cm. Parasitic device elements are identified and their influence on determination of normalized degradation parameters is discussed. A comparison between Si and GaAs J-FETs of comparable channel doping is presented. Author (GRA)

N71-31760# Aerospace Corp., El Segundo, Calif.
EARTH FOOTPRINTS OF SATELLITE ANTENNA Technical Report, Jul. 1969 - May 1970
Ernest Jacobs and Joseph Stacey 15 Jan. 1971 36 p
(Contract F04701-70-C-0059)
(AD-723284; TR-0059(6230-30)-9; SAMSO-TR-71-76) Avail: NTIS CSCL 9/5

A model for computing the footprints on earth (i.e., power density contours) of a satellite antenna is developed. The antenna pattern coordinate is expressed as a function of the earth coordinates. In addition, the antenna pattern operator, which converts

the pattern function into the available power density, is obtained. In this case, it is assumed that the earth-based antenna is directed toward the satellite. The radar operator is also derived; this operator yields the power density intercepted by the earth. Author (GRA)

N71-31808# Air Force Cambridge Research Labs., Bedford, Mass. Data Sciences Lab.
RECEIVING ARRAY COEFFICIENTS THAT MINIMIZE INTERFERENCE AND NOISE
John N. Pierce 28 Dec. 1970 33 p ref *Its* Phys. Sci. Res. Papers No. 445
(AD-723628; AFCRL-71-0079) Avail: NTIS CSCL 9/5

A formula is derived for the optimum combining coefficients for an antenna array in order to maximize the signal-to-noise ratio in the presence of external interference and local noise. The parameters necessary for the optimization can be determined from in-place measurements on the array element outputs, or can be calculated from known statistics of the interference. The technique is illustrated by theoretically optimized arrays for single and multiple interfering sources at fixed locations, for distributed sky noise, for randomly located interfering sources, and for interfering sources at fixed but uncertain location. The technique lends optimizing the performance of electronically steerable arrays. Author (GRA)

N71-32040# Gosudarstvennyi Komitet po Ispolzoveniyu Atomnoi Energii, Moscow (USSR). Inst. Teoreticheskoi i Eksperimentalnos Fziki.
REGULATOR FOR HIGH VOLTAGE CAPACITOR BANK
A. M. Kozodaev and N. V. Lazarev 1970 11 p In RUSSIAN; ENGLISH summary
(ITEF-761) Avail: AEC Depository Libraries

The high voltage capacitor bank of 2.8 microfarad is charged through the unregulated rectifier, connected to the secondary winding of the step-up transformer. Regulation of the capacitor bank voltage of 10 to 40 kV with an accuracy of + or − 0.1% at any periodic or unperiodic discharges, at separated time intervals greater than 0.7 sec, is accomplished with an SCR 2 phase bridge connected between the primary winding and the supply line. Author (NSA)

N71-32122# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
ISOTOPIC ELECTRICITY GENERATORS [GENERATEURS ISOTOPIQUES D'ELECTRICITE]
Francoise Laveissiere Jan. 1971 44 p refs In FRENCH
(CEA-Bib-190) Avail: AEC Depository Libraries

Reports giving technical and economic information on the achievements of several countries (USA, France, UK, Euratom, USSR, and Canada) on isotopic electricity generators are presented. Each report contains information on the radioisotope used, activity of the source, output wattage, generator lifetime, manufacturer, type of conversion used, generator weight, and primary use. Author (NSA)

N71-32151 Wisconsin Univ., Madison.
RADIATION PROCESSES AND INSTRUMENTAL CONSIDERATIONS FOR THE TEMPORALLY AND SPATIALLY RESOLVED STUDY OF A HIGH VOLTAGE SPARK DISCHARGE
Richard Douglas Sacks (Ph.D. Thesis) 1969 424 p
Avail: Univ. Microfilms Order No. 70-3687

A high voltage, unidirectional spark was positionally stabilized through the use of an electronically triggered, diode controlled spark source and special electrode geometry. With wandering reduced to less than 0.25 mm., radial emission distributions were obtained for an aluminum spark in nitrogen. Using a stigmatic optical image transfer system feeding a time gated spectrograph, radial intensity distributions were plotted for aluminum and nitrogen with spatial resolution of 0.05 mm. and temporal resolution of 0.2 microsecond. Measurements were made at four axial positions starting at the cathode surface and extending out to 0.3 mm. from the cathode. A computational procedure was developed to convert observed line intensities into radial distribution maps using a model which contained 50 radial zones and 50 observation zones. Of particular concern was how sampled electrode material interacts with the current conducting plasma in the space charge immediately after being removed from the electrode surface to influence the radiation patterns in other regions of the gap. Dissert. Abstr.

N71-32223# Aerospace Corp., El Segundo, Calif. Lab. Operations.
RADIATION FROM SLOT ANTENNAS ON CONES Research Report, Jan. – Dec. 1970
David C. Pridmore-Brown and Gordon E. Stewart 1 Feb. 1971 45 p refs
(Contract F04701-70-C-0059)
(AD-723289; TR-0059(6220-10)-10; SAMSO-TR-71-77) Avail: NTIS CSCL 9/5

Integral representations are given for the radiation field from slots on the surface of a semi-infinite conducting cone. The corresponding normal mode representations for delta function circumferential slots are evaluated numerically for various cone angles, slot positions, and azimuthal variations. Experimentally measured patterns for two finite models are reported and compared with the semi-infinite cone theory. In particular, effects due to finite cone length and finite tip radius are discussed. Author (GRA)

N71-32224# Naval Weapons Lab., Dahlgren, Va.
A REFLECTOMETER METHOD FOR RF IMPEDANCE MEASUREMENTS
John F. Cavanagh and Thomas C. Hayes Oct. 1970 38 p refs
(AD-721509; NWL-TR-2522) Avail: NTIS CSCL 9/6

A method of measuring RF impedances was developed which makes use of commercially available vector voltmeters and bi-directional coaxial couplers to form a reflectometer. The use of this reflectometer in shipboard antenna impedance measurements resulted in a substantial saving in the time rter convenience was also realized for remotely located antennas. Estimates of the expected accuracy which can be achieved are presented together with comparisons of measurements of the same impedance made with both the reflectometer and an RF impedance bridge. Author

N71-32283# National Bureau of Standards, Boulder, Colo. Electromagnetics Div.
A BROADBAND NONCONTACTING SLIDING SHORT
Wilbur Larson and Ronald D. Hunter Jun. 1971 20 p refs
(NBS-TN-602) Avail: SOD $0.30

A description is given of a new sliding short that eases microwave measurements and yields superior electrical and mechanical properties. The device is easily fabricated by encasing noncontacting cylindrical brass slugs in a block of polytetrafluoroethylene. It slides smoothly, and prevents metal-to-metal contact with the inside walls of precision waveguide. Design details and results of intercomparing other short circuits are given. Author

N71-32280*# Battelle Memorial Inst., Columbus, Ohio. Radiation Effects Information Center.
RADIATION EFFECTS DESIGN HANDBOOK. SECTION 2: THERMAL-CONTROL COATINGS
N. J. Broadway Washington NASA Jun. 1971 194 p refs
(Contract NASw-1568)
(NASA-CR-1788) Avail: NTIS CSCL 09A

Information relating to steady-state radiation effects on thermal-control coatings. The radiation includes nuclear, charged

particles, and ultraviolet. The data provide useful information to the design engineer responsible for choosing thermal-control coatings in space applications. Author

N71-32310# Stanford Univ., Calif. Electronics Labs.
AN ACCURATE MODEL FOR THE SHORT CHANNEL INSULATED GATE FIELD-EFFECT TRANSISTOR
De Witt Paul Smith Mar. 1971 103 p refs
(Contract N00014-67-A-0112-0038)
(AD-723215; SU-SEL-71-005; TR-4825-4) Avail: NTIS CSCL 9/1

An accurate short channel insulated gate field-effect transistor IGFET model is described which includes the effect of the drain depletion region on device characteristics in both triode and saturation regions. Calculation of deviations from the classical triode and saturation equations caused by interaction between the drain depletion region and the surface inversion region in devices constructed on lightly doped (10 to the 16th power/cu cm) substrates is reduced from an analytically untractable two-dimensional field problem to the solution of two simple one-dimensional field problems. In the saturation region, deviation from the classical saturation response is computed from a simple but accurate analytic expression for channel length as modified by the drain depletion region. This bias dependent channel length modifies the forward transfer coefficient of the device such that B prime = f(V sub G, V sub D). Continuity between tirode and saturation characteristics is utilized to define a bias dependent effective threshold voltage V sub TE = f(V sub G, V sub D), which replaces the classical turn-on voltage in the triode region equation. The overall result is a simple, physically derived model which is shown to accurately describe the terminal characteristics of short channel IGFETs in terms of the geometrical channel length of the device. Author

N71-32329# Schjeldahl (G. T.) Co., Northfield, Minn.
FEASIBILITY STUDIES OF MOSAIC NEAR-INFRARED IMAGE CONVERSION PANELS Technical Report, 1 Feb. 1970 - 31 Jan. 1971
Donald E. Anderson and Richard L. Swisher 15 May 1971 114 p refs
(Contract N00014-70-C-0231)
(AD-723524; SER-0088) Avail: NTIS CSCL 9/5

Two digital computer simulation techniques are presented for use in evaluating the performance of mosaic patterned, photoconductive sensor/electroluminescent output, image conversion panels. One simulation technique is used for rapid calculation of output light for continuous input radiation levels varying over six orders of magnitude with the simulated panel operated at up to five different applied drive frequencies at each of five drive voltages. The second simulation technique evaluates the output brightness of the panel when operated at one frequency and voltage, but exposed to input radiation of chosen peak intensity and a square wave time profile. These computer simulations were used to evaluate combinations of available electroluminescent (EL) materials and near-infrared sensitive thin film photoconductors. Combinations such as PbS photoconductor with thin film ZnS:Mn EL lamps, CdSe photoconductor with thin film ZnS:Mn EL lamps, and CdSe photoconductor with thick film ZnS:Cu, Cl EL lamps were investigated. GRA

N71-32341 Auburn Univ., Ala.
ANTENNA ELEMENTS THAT ENABLE A PHASED ARRAY TO BE SCANNED OVER A HEMISPHERICAL SECTOR
Pierce Johnson, Jr. (Ph.D. Thesis) 1969 161 p
Avail: Univ. Microfilms Order No. 70-17430

The development of a cavity-backed crossed slot antenna for use in a phased array is presented. One of the requirements is that the array be scanned over a hemisphere. To simplify the design, a unique loop feed was used to connect the signal source or receiver to the cavity. The characteristics of the crossed slot and loop-fed cavity make the element especially well suited for use in phased arrays that are to be scanned over wide angles. A theoretical technique for analyzing this type of element is formulated and used to predict both the frequency behavior and the effect of changes in the feed configuration on the polarization characteristics of the antenna. Experimental results obtained from two planar arrays consisting of thirty six crossed slot elements arranged in a square grid are presented. Dissert. Abstr.

N71-32356 Pennsylvania Univ., Philadelphia.
MECHANISMS OF RADIATION INITIATED SEMICONDUCTOR DEVICE FAILURES
John Edward Tarka (Ph.D. Thesis) 1969 252 p
Avail: Univ. Microfilms Order No. 70-16219

A series of experiments performed on discrete devices, which included pulsed radiation and pulsed electrical verification tests, exclusive of one another, served as the basis for proof that radiation initiated second breakdown is the primary failure mechanism for several of the commonly observed semiconductor failure modes. In several cases of these failures, direct evidence of the effects of a mesoplasma formed during the second breakdown mode were observed through crater like formations that originated in the active region of the junction. It is inferred that the phenomenon referred to as latchup in dielectrically isolated integrated circuits is due to the action of a self sustaining mesoplasma, and may or may not lead to a catastrophic failure mode, depending on the circuit configuration in which it is tested. A unique experimental method for using a super flash X-ray machine operating in the electron mode was also developed. The electromagnetic coupling of this electron beam into the monitoring electronics, at a pulsed radiation level of 50,000 rads (Al), was less than 20 millivolts peak to peak. Dissert. Abstr.

N71-32361 Colorado Univ., Boulder.
AN EXPERIMENTAL INVESTIGATION OF SLOWLY PROPAGATING DOMAINS IN GALLIUM ARSENIDE
Emil James Crescenzi, Jr. (Ph.D. Thesis) 1969 171 p
Avail: Univ. Microfilms Order No. 70-16473

An experimental investigation of domains which propagate with velocities between 5,000 and 500,000 cm/sec in n-type oxygen doped GaAs of about 1500 cm resistivity was reported for devices which are typically 3 × 1 × 0.1mm. Domain formation occurred only when the electric field near the cathode of the device exceeds 3 kv/cm and when the semiconductor was optically excited by excitation which could be limited to photons with energies at least 0.4 ev less than the forbidden band gap energy. Probe measurements of device potential as a function of distance and time were accomplished for various combinations of applied voltage and incident light intensity and wavelength. Identification of several of the impurities present in the semiconductor was accomplished by photoconductivity measurements. The identification of preferential capture of satellite valley electrons by deep impurities as most likely being responsible for the properties of the observed domains was reported. Dissert. Abstr.

N71-32364 Pittsburgh Univ., Pa.
STABILITY ANALYSIS OF CLASS C TRANSISTOR AMPLIFIERS
John Choma, Jr. (Ph.D. Thesis) 1969 139 p
Avail: Univ. Microfilms Order No. 70-16366

The likely sources of possible instability in class C transistor amplifiers were investigated. The stability analysis was directed toward the active device itself. This stability analysis approach lends itself nicely to generalized results that can be cast into a form which portrays the potential instability conditions of a class C operated transistor, independent of the nature of the circuitry which is external to the active device. The class C operated transistor was

considered as a superposition of a conducting (or ON) transistor and a non-conducting (or OFF) transistor. This model of the active device enables discussion of potential instabilities caused by four effects: cutoff, transition of the device from cutoff to active region operation and vice versa, active region peculiarities, and transition of the transistor from active to nearly saturated mode and vice versa. Throughout the course of the investigations, discussions of results were presented in the form of design criteria which are immediately applicable to common emitter, common base, and common collector transistor class C amplifiers. Dissert. Abstr.

N71-32371*# National Aeronautics and Space Administration, Washington, D.C.
CABLES AND CONNECTORS: A COMPILATION
1971 27 p refs
(NASA-SP-5936(01)) Avail: NTIS CSCL 09A

Brief descriptions are presented on devices for maintenance, safety, and repair, special purpose connectors, and adapters for possible technology transfer. These include quick couplers and disconnects, connector keying, alignment devices, attachment devices, wire and cable identification, coaxial cable problems, cable handling, assembly, and insulation. N.E.N.

N71-32390*# Texas Instruments, Inc., Dallas.
SOLID STATE MICROWAVE SOURCE DEVELOPMENT PROGRAM Final Report
W. R. Wisseman, H. Q. Tserng, D. W. Shaw, and T. E. Hasty Jun. 1971 49 p refs
(Contract NAS8-25847)
(NASA-CR-119915; Rept-08-71-38) Avail: NTIS CSCL 09A

The device development program is described, including the basic solid state structure, materials development, fabrication, and evaluation. An extensive device characterization effort prior to the design and testing of a microstrip oscillator during circuit development is discussed. Experimental results are summarized, along with suggestions for future research. The GaAs Schottky barrier diodes were used to support K sub u-band Gunn local oscillator. Author

N71-32403 Michigan State Univ., East Lansing.
RADIATION FROM DIELECTRICALLY COATED SPHERICAL ANTENNAS
August Golden, Jr. (Ph.D. Thesis) 1969 162 p
Avail: Univ. Microfilms Order No. 70-15036

The edge admittance of a perfectly conducting spherical antenna, which is driven by a voltage source acting across a slot at the sphere's equatorial plane and which is covered by a layer of homogeneous dielectric or ferromagnetic material, is defined and derived by solving the related boundary value problem. Subsequently, the radiation field is derived and plotted, along with the edge admittance, for many examples. After the edge admittance formulation is extended to the case of an N-layered spherical antenna by means of a transmission line analogy, a method of formulating the antenna's input impedance is presented. Finally, an experimental verification of the theoretical predictions concerning the radiation field of a single-layered structure is given for one example. Dissert. Abstr.

N71-32410*# General Electric Co., Schenectady, N.Y.
PERFORMANCE OF A TEN-STAGE ELECTROSTATIC DEPRESSED COLLECTOR FOR KLYSTRONS
W. Neugebauer and T. G. Mihran [1971] 24 p
(Contract NAS3-11532)
(NASA-CR-119683) Avail: NTIS CSCL 09E

A computational method, designed to increase the net power conversion efficiency of a klystron, using an electrostatic depressed collector, is described. Results indicate the improved efficiency can be achieved over a two-to-one range of the base tube. This indicates that the depressed collector is directly applicable to AM klystron service. E.H.W.

N71-32411# Air Force Weapons Lab., Kirtland AFB, N.Mex.
SYSTEMS ANALYSIS USING THE SCEPTRE PROGRAM Technical Report, 1 Dec. 1968 – 1 Jun. 1969
Julien S. Nichols and David R. Alexander Apr. 1971 35 p refs
Presented at the IEEE Conf. on Nucl. and Space Radiation Effects, 1969 Sponsored in part by DASA
(AD-723637; AFWL-TR-70-50) Avail: NTIS CSCL 9/5

The techniques that were developed that permit SCEPTRE to handle linear transfer functions are used to demonstrate how to analyze a multifeedback loop control system which contains a combination of linear, radiation insensitive blocks and nonlinear, radiation sensitive blocks. The output of the system and the electrical signals at critical points within the system are determined for conditions of normal operation, operation in an ionizing radiation environment in which only one unit of the loop is assumed to be radiation sensitive, and operation in a neutron environment in which the same unit is assumed to be sensitive. Author (GRA)

N71-32435 National Lending Library for Science and Technology, Boston Spa (England).
THE INFLUENCE OF CONTACT-BREAKING SPEED ON THE SPARK-QUENCHING CHARACTERISTIC
P. Lohse 8 Oct. 1970 9 p refs Transl. into ENGLISH from Frequenz (West Berlin), v. 24, no. 3, Mar. 1970 p 84–87
(NLL-Trans-2662-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

For a constant inductance of the load to be disconnected two characteristic regions i sub 0 alpha C(1/2) and i sub 0 alpha C are observed in an i sub 0 – C presentation of the experimental boundary curve between spark quenching and gas discharge (i sub 0 = steady state current before disconnection, C = capacitance in parallel to the contact). The positions of these regions depend essentially on the contact type (dry reed and follow-through-travel contact, respectively). This behavior is attributed to differences in the dynamics of the contact when opening. Author

N71-32485*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
EVALUATION OF NOVEL DEPRESSED COLLECTOR FOR LINEAR-BEAM MICROWAVE TUBES
Francis E. Kavanagh, Robert E. Aleksovich, and Gerald J. Chornos Washington Aug. 1971 24 p refs
(NASA-TM-X-2322; E-6224) Avail: NTIS CSCL 09A

Laboratory evaluation tests were conducted to demonstrate the feasibility of increasing the efficiency of microwave tubes, having a large axial and radial velocity spread in the spent beam, using a novel collector design. The first iteration yielded a collector efficiency of 57 percent on an electrostatically focused klystron. Previous to this work, conventional depressed collector efficiencies on tubes having similar velocity distribution have been in the order of 25 to 38 percent. Improved designs are expected to raise collector efficiencies to 75 percent or more and promise to significantly improve the overall efficiencies of linear beam microwave tubes without the adverse effects experienced with previous collector designs. Author

N71-32471# Carnegie-Mellon Univ., Pittsburgh, Pa. Management Sciences Research Group.
DOUBLE FAILURE AND OTHER RELATED PROBLEMS IN STANDBY REDUNDANCY
Claude Henin Aug. 1970 30 p refs
(AD-723095; RR-217) Avail: NTIS CSCL 14/4

The branch and bound algorithms previously described, is extended to parallel standbys redundancy subject to both open and short circuit failures. The algorithm is then modified to consider parallel-series arrangements of such standbys, and is also applied to solving problems where there is a choice of components at each stage. In the last section, the two types of failures are separated in the constraints of the problems. Author (GRA)

N71-32609*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

AN APPROACH TO A MODULAR SYSTEM-ORIENTED DISCHARGE-CHARGE CONTROLLER FOR AUTOMATED POWER-SOURCE EVALUATION

Smith E. D. Tiller Mar. 1971 63 p

(NASA-TM-X-65648; X-761-71-178) Avail: NTIS CSCL 09E

The studies and methods of a space power field group for controlling experiments with a discharge-charge controller are discussed. During the evaluation, some pertinent problems were found in the remote and local programming, remote voltage-sense switching circuits, ac power failure, load-switching circuits, ac power failure, load-switching relay current surges, and inadequate fail-safe protection. Design methods are suggested for resolving or minimizing each problem area. Author

N71-32612*# Hughes Aircraft Co., Torrance, Calif. Electron Dynamics Div.

MULTISTAGE DEPRESSED COLLECTOR INVESTIGATION FOR TRAVELING-WAVE TUBES Final Report

I. Tammaru Jun. 1971 92 p refs

(Contract NAS3-11536)

(NASA-CR-72950; EDD-W-3207) Avail: NTIS CSCL 09A

Methods of analysis were developed for asymmetric multistage depressed collector schemes, with and without an initial transverse magnetic field. The scheme included beam expansion and refocusing into parallel flow prior to injection into the collector. A two-stage test collector was evaluated with a traveling-wave tube operated at 9 GHz and 4 kW output power for the purpose of verifying the analysis procedure. Satisfactory agreement was obtained between measured and predicted performance although some assumptions had to be made because of nonideal experimental conditions. A four-stage asymmetric collector was designed, which promised to increase a tube efficiency of 28% to about 50%. It was concluded that a cylindrically symmetric collector is generally to be preferred over the asymmetric types that were investigated. Author

N71-32616 George Washington Univ., Washington, D.C.

A MATHEMATICAL MODEL FOR THE DETERMINATION OF SYSTEM BURN-IN TIMES IN COMPLEX ELECTRONIC EQUIPMENT

Victor Selman (Ph.D. Thesis) 1969 184 p

Avail: Univ. Microfilms Order No. 70-16908

An integrated systems approach to determine system burn-in times in complex electronic equipment is presented. A mathematical model is formulated which provides the reliability engineer with a step-by-step methodology for proceeding toward decision thresholds in the burn-in stage. At these threshold points the complex electronic equipment is either (1) accepted for demonstration of reliability conformance, (2) approved for modification or new generation equipment, or (3) the contract is terminated before the funds are expended for ineffectual modifications. A flow chart logic algorithmic model is developed to accommodate a number of failure parameters along with a generalized power function for the cumulative and instantaneous (current) failure rate curve. Dissert. Abstr.

N71-32652 Minnesota Univ., Minneapolis.

STUDY OF NOISE IN TRANSISTORS AT MICROWAVE FREQUENCIES UP TO 4 GHz

Shashi Dhar Malaviya (Ph.D. Thesis) 1969 130 p

Avail: Univ. Microfilms Order No. 70-15771

The theory of noise in microwave transistors is analyzed. The effects of feed-back due to a capacitance between the input and output are also included in the analysis. A few noise parameters are introduced during the analysis to simplify the work and to present the final expression for noise figure in a compact form. The noise parameters are then expressed in terms of the directly measurable small signal parameters of the transistor and several approximations are made and justified to make these expressions simpler. With this approach, it was found possible to arrive at a final expression for minimum noise figure which is quite simple in form and yet sufficiently accurate for engineering applications. The conditions under which the various approximations are valid are clearly laid out. The effects of high injection levels and drift field in the base due to non-uniform doping are also discussed. Dissert. Abstr.

N71-32660 Illinois Inst. of Tech., Chicago.

THEORY AND REALIZATION OF BAND PASS GYRATORS

Francis Edwin Edwards (Ph.D. Thesis) 1970 111 p

Avail: Univ. Microfilms Order No. 70-15430

A study was made of the fundamental factors limiting the frequency at which a gyrator circuit can operate for the development of a gyrator circuit capable of operation at a frequency of one megahertz. The ideal gyrator was defined and its properties were deduced. From the fundamental properties of the circuit elements to be used, the unavoidable differences between an ideal and an actual gyrator were derived. The dependence of the functioning of an actual gyrator on the external impedances with which it is associated is demonstrated. By the use of plots in the complex plane representing solutions of the characteristic equations of systems containing gyrators, it is shown that high frequency operation can be achieved by the sacrifice of low frequency performance. Factors affecting the dynamic stability of the system are derived and the limits of stable operation defined. Dissert. Abstr.

N71-32698*# Battelle Memorial Inst. Columbus, Ohio. Radiation Effects Information Center.

RADIATION EFFECTS DESIGN HANDBOOK. SECTION 6: SOLID STATE PHOTODEVICES

J. E. Drennan Washington NASA Aug. 1971 32 p refs

(Contract NASw-1568)

(NASA-CR-1872) Avail: NTIS CSCL 09A

This document summarizes information concerning the effects of radiation on solid-state photodevices, especially solar cells. The forms of radiation include neutrons, protons, electrons, and electromagnetic. Several curves are presented. Author

N71-32705 National Lending Library for Science and Technology, Boston Spa (England).

EFFECT OF HUMIDITY ON THE FLASHOVER VOLTAGES OF LONG SPARK GAPS

G. N. Aleksandrov 16 Sep. 1970 8 p refs Transl. into ENGLISH from Elektr. St. (Moscow), v. 40, Aug. 1969 p 71–74

(NLL-CE-Trans-5367-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupons

The correction curves for taking into account the effect of humidity were derived from tests made in different countries on spark gaps and insulating arrangements up to 1 m long (for voltages up to 400 kV). Attempts to use the Gost method for correcting the measured flashover voltages of long spark gaps to normal atmospheric conditions at an outdoor test unit proved unsuccessful. A study was also made on the effects of the parameters of atmospheric air on the flashover voltages of long spark gaps. Author

N71-32747# National Bureau of Standards, Boulder, Colo. Time and Frequency Div.

EFFICIENT NUMERICAL AND ANALOG MODELING OF FLICKER NOISE PROCESSES

J. A. Barnes and Stephen Jarvis, Jr. Jun. 1971 24 p refs
(NBS-TN-604) Avail: SOD $0.35

It is shown that by cascading a few simple resistor-capacitor filters, a filter can be constructed which generates from a white noise source a noise signal whose spectral density is very nearly flicker over several decades of frequency. Using difference equations modeling this filter, recursion relations are obtained which permit very efficient digital computer generation of flicker noise time-series over a similar spectral range. These analog and digital filters are also viewed as efficient approximations to integrators of order one-half. Author

N71-32771# Maryland Univ., College Park. Dept. of Electrical Engineering.
A PASSIVE N-PATH FILTER REALIZATION

Sooyoung Chang, N. De Claris, and R. Newcomb May 1971 13 p refs
(Grants AF-AFOSR-1910-70; NSF GK-24036)
(AD-723656; AFOSR-71-1318TR) Avail: NTIS CSCL 9/5

Through the intermediary of state-variable equations an equivalence is obtained which shows how passive RC circuits incorporating time-variable gyrators can be used to realize N-path filters. The effects of gyrator losses in the realization of time-invariant transfer functions are briefly discussed to indicate the practical significance of the result. Author (GRA)

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

N71-31628# Kentucky Univ., Lexington. Coll. of Engineering.
PROCEEDINGS OF 1970 CARNAHAN CONFERENCE ON ELECTRONIC CRIME COUNTERMEASURES

Apr. 1970 252 p refs Conf. held at Lexington, Ky., 16-18 Apr. 1970; Sponsored in part by Ky. Comm. on Law Enforcement and Crime Prevent. /its Bull. 92
(PB-190589) Avail: NTIS CSCL 05K

Conference papers are presented on research and development of electronic surveillance equipment and techniques, computerized information systems, and law enforcement systems. For individual titles, see N71-31629 through N71-31651.

N71-31629# MITRE Corp., McLean, Va.
A POLICE CAR SIMULATION MODEL: CONVENTIONAL VERSUS AVM DISPATCHING

Robert A. Bales /n Kentucky Univ. Proc. of 1970 Carnahan Conf. on Electron. Crime Countermeas. Apr. 1970 p 1-29 refs (See N71-31628 19-10)
Avail: NTIS

An automatic vehicle monitoring (AVM) system for dispatching police vehicles is compared to the conventional dispatching system. The types of operation for which the AVM is considered advantageous are: emergency response, coordinated closure, riot, and demonstration control. A Monte Carlo model developed for a digital computer is described, and the results of the probabilities for various distances to be traveled by responding vehicle for both systems are presented. It is concluded that patrol beats should be square to minimize response time when the conventional dispatching method is used. When the beats are square and all cars are available, the AVM system can only improve the dispatching in about one-third of the dispatches. When only twenty per cent of the cars are available, it can improve on about one-fifth of the dispatches. The AVM can improve dispatching more when the beats are elongated. F.O.S.

N71-31632# Philco-Ford Corp., Willow Grove, Pa.
PROBLEMS ENCOUNTERED IN THE DESIGN OF SPEECH PRIVACY SYSTEMS

Charles F. Teacher /n Kentucky Univ. Proc. of 1970 Carnahan Conf. on Electron. Crime Countermeas. Apr. 1970 p 44-58 refs (See N71-31628 19-10)
Avail: NTIS

The design of speech privacy systems to meet law enforcement needs is discussed. The estimated hours of privacy of any unit are shown to be directly proportional to the number of independent codes available. Digital techniques are considered to offer a noncompatible, revolutionary approach while corresponding analog systems offer a compatible evolutionary approach. Author

N71-31633# Radiation, Inc., Melbourne, Fla. System Div.
AREA DENIAL SYSTEM DESIGN

Guy H. Smith, Jr. /n Kentucky Univ. Proc. of 1970 Carnahan Conf. on Electron. Crime Countermeas. Apr. 1971 p 59-81 refs (See N71-31628 19-10)
Avail: NTIS

Area denial and surveillance systems that provide remote sensing and environment analysis are discussed in terms of unattended sensor operation and low false alarm rates. The advantages of area denial systems are mobility, quick reaction capability, reconfiguration flexibility, and covert operation. One of the most basic problems in designing the system is considered to be the data rate the system must accommodate; other major elements that must be considered are also discussed. F.O.S.

N71-31637# Mason (F. G.) Engineering, Inc., Fairfield, Conn.
UTILIZATION OF ELECTRONIC SURVEILLANCE EQUIPMENT IN CRIME COUNTERMEASURE PROGRAMS

Samuel W. Deskam /n Kentucky Univ. Proc. of 1970 Carnahan Conf. on Electron. Crime Countermeas. Apr. 1970 p 98-113 (See N71-31628 19-10)
Avail: NTIS

The methods available to the law enforcement agencies who are responsible for the security of areas against threats of electronic eavesdropping are covered. Methods utilizing broad tuning range receivers are described and the basic operating theory is discussed. Spectrum analyzers, diode detectors, wave meters as well as full surveillance receiving systems are discussed including their advantages, disadvantages, and costs. Problems concerning location of subcarriers, power line audio transmission such as those used with wireless intercoms, and other areas of concern are included. Author

N71-31640# Stanford Research Inst., Menlo Park, Calif.
SYSTEM EVALUATION OF VICTIM ACTIVATED, SILENT ALARM SYSTEMS

Jim Gilkey and George Byrne /n Kentucky Univ. Proc. of 1970 Carnahan Conf. on Electron. Crime Countermeas. Apr. 1970 p 132-136 (See N71-31628 19-07)
Avail: NTIS

As part of a study into potential measures to counter robbery and assault of bus operators, the effectiveness of silent holdup alarm systems was evaluated. Data from various commercial central stations were compiled for several types of alarm configurations. It was found that there is a relatively low probability of on-site capture. This conclusion was corroborated by the experience of one major transit system that installed silent alarms on a large number of their buses. Specific attention was given to determining the time required for the police to get to the scene of the robbery. This was compared with typical perpetration and getaway times. In general, the delays, under even the most optimistic circumstances, are shown to exceed significantly the time required to execute the crime. The problem of false alarms from victim-activated alarm systems is also analyzed. Author

N71-31643# Radio Corp. of America, Lancaster, Pa. Electronic Components.
NIGHT SURVEILLANCE FOR LAW ENFORCEMENT
R. G. Studenheimer and R. D. Faulkner *In* Kentucky Univ. Proc. of 1970 Carnahan Conf. on Electron. Crime Countermeas. Apr. 1970 p 148–152 (See N71-31628 19-10)
Avail: NTIS

A description is given of how image intensification is accomplished in night surveillance systems and factors affecting the systems performance are outlined. Image intensifier cameras, infrared systems, and high sensitivity vidicons are described for use in police surveillance and law enforcement. J.M.

N71-31644# General Dynamics/Convair, San Diego, Calif.
DEVELOPMENT OF PASSIVE ELECTROSTATIC FIELD EFFECT INTRUSION DEVICE
Clark M. Hay and Robert E. Moore *In* Kentucky Univ. Proc. of 1970 Carnahan Conf. on Electron. Crime Countermeas. Apr. 1970 p 159–165 refs (See N71-31928 19-07)
Avail: NTIS

During the development of remote biomedical instrumentation for heart beat monitoring it was noted that movements of the subject and others in the room produced unwanted signals. Studies into the nature of these unwanted signals resulted in the development of a passive intrusion detection device. Author

N71-31646# JTR Electronics, Adelphi, Md.
AN ELECTRONICALLY KEYED LOCK AND SECURITY SYSTEM
James D. Terrell and A. J. Ramsbotham, Jr. *In* Kentucky Univ. Proc. of 1970 Carnahan Conf. on Electron. Crime Countermeas. Apr. 1970 p 172–184 (See N71-31628 19-07)
Avail: NTIS

The design of an electronic combination lock system, with built-in alarm features, is described. A discussion is given on the application of the system to multi-unit apartment and office complexes. Author

N71-31651# Sylvania Electronic Systems-West, Mountain View, Calif.
AN INTRUSION DETECTOR FOR PARKED AIRCRAFT
R. F. Bell *In* Kentucky Univ. Proc. of 1970 Carnahan Conf. on Electron. Crime Countermeas. Apr. 1970 p 239–246 (See N71-31628 19-07)
Avail: NTIS

The technique and equipment developed to detect an individual touching an aircraft are described. The sensing technique is the change of electrical capacitance caused by the human touch. The system described differs from previous capacitive systems in that digital processing is used. This allows the detector to compensate more effectively for environmental changes and eliminate false alarms due to rain, wind, and snow. Also, the equipment may be operated by unskilled personnel since no adjustments are required. The basic detection technique may also be used in other security applications. Author

N71-31825# Illinois Univ., Urbana. Coordinated Science Lab.
FAULT DIAGNOSIS IN FET MODULES
M. Paige and G. Metze May 1971 14 p refs
(Contract DAAB-07-67-C-0199)
(AD-723442; R-507; UILU-ENG-71-2210) Avail: NTIS CSCL 9/2

The use of Field Effect Transistor (FET) devices in logic design has changed the design emphasis from networks composed of single logic gates to networks composed of complex functional modules. Fault diagnosis techniques which have been discussed in the literature are based on the former type networks and hence are somewhat inadequate for this new technology. This pap presents an approach to the generation of tests to detect all sing and multiple faults of the stuckline type in FET modules realizing complex functions. These networks are treated in a uniform manner and a uniform notation is adopted for the tests required fo diagnosis. Author (GRA

N71-32092# Commisariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
HIGH DYNAMIC RANGE RISE TIME TO AMPLITUDE CONVERTER [CONVERTISSEUR TEMPS DE MONTEE-AMPLITUDE A GRANDE DYNAMIQUE D'ENTREE, UTILISABLE POUR LA DEFINITION TEMPORELLE]
M. Prieur-Drevon and J. Ros Feb. 1971 12 p refs In FRENCH ENGLISH summary
(CEA-N-1430) Avail: AEC Depository Libraries

A circuit providing output signals, the amplitude of which is proportional to the rise time of the input pulses defined between 20 and 70 percent of the maximum, is described. The dynamic range is 100: 1 for the input pulse amplitude. The converted rise times range between 10 ns and 1.5 micro sec in 4 ranges. The circuit may also be used for detecting the time of arrival of pulses with variable amplitude and rise time. Author (NSA)

N71-32208# Sandia Corp., Albuquerque, N.Mex.
GENERALIZED INTEGRATED CIRCUIT
David G. Skogmo Mar. 1971 26 p Sponsored by AEC
(SC-DR-710033) Avail: NTIS

The feasibility of an integrated circuit containing all the active elements required to produce a functional circuit was investigated. The circuit was designated the generalized integrated circuit (GIC) and consists of transistors, diodes, and a few diffuser resistors that are only partially connected. For the GC to be used to fashion a functional circuit it must be completed with external resistors and interconnection conductors. Autho

N71-32219# Sandia Corp., Albuquerque, N.Mex.
CHARACTERIZATION OF THE IONIC SPECIES INCIDENT ON THE CATHODE IN A GLOW DISCHARGE
J. E. Houston and J. E. Uhl Mar. 1971 38 p refs Sponsored by AEC
(SC-RR-710122) Avail: NTIS

A discussion is given concerning the apparatus and preliminary results of an experimental program whose overall purpose is a better characterization of the cathode environment in a glow discharge. The initial effort concentrates on a determination of the energy distributions for the ionic species incident on the cathode for a wide range of working gases and discharge parameters. Sample results include spectra for the species A(+), A++), A2(+), and Mo(+). In addition, data concerning the angular distributions of ions arriving at the cathode are also presented. Author

N71-32272 Montana State Univ., Missoula.
MINIMIZATION METHODS FOR CELLULAR LOGIC ARRAYS
Harold Gregory Schmitz (Ph.D. Thesis) 1970 155 p
Avail: Univ. Microfilms Order No. 70-14700

An algorithm is presented which obtains a realization for an arbitrary switching function using a minimal size two-dimensional cellular logic array in which each cell is capable of producing all two-input one-output unate functions and in which the interconnection structure is constrained to be nearest neighbor. The number of equivalence classes of unate cascade realizable functions is determined, and a necessary condition and improved test for determining unate cascade realizability is given. A solution to a classical minimization problem involving the Reed–Muller canonic forms is provided and minimization techniques for two-dimensional

cellular arrays based on the Reed–Muller forms are developed. An essential step in the cellular array minimization algorithms is formulated as a graph theoretic problem whose solution requires finding the cliques of a linear nondirected graph. For this, a new algorithm for detecting the cliques of a linear nondirected graph is developed. Dissert. Abstr.

N71-32288 Pennsylvania Univ., Philadelphia.
THE ELECTROMAGNETIC RADIATION FROM A SLOTTED CIRCULAR DISK
John Elwood Mutholland (Ph.D. Thesis) 1969 161 p
Avail: Univ. Microfilms Order No. 70-16190

The radiation fields of a slotted circular disk were analyzed. Initially, the spheroidal coordinate system was defined and Maxwell's equations were expressed in differential form. The general expressions for the fields were then derived and shown to be solutions of the scalar Helmholtz equation for the time-harmonic case. With a prescribed electric field source distribution over the surface of the disk, the coefficients of the radiated field expansion were found, and from this general expansion the near and far fields could be derived. With the near field solution, the current distribution on the disk was found and in turn the input admittance was determined. From the far field solutions, the antenna parameters such as the pattern function, directivity, and radiation resistance could be calculated. A field expansion for the radiated fields of a slotted circular disk was obtained through the solution of a vector boundary value problem in the oblate spheroidal coordinate system. Dissert. Abstr

N71-32327# Union Carbide Corp., Oak Ridge, Tenn.
EDDY CURRENT MEASUREMENTS WITH A COIL ENCIRCLING A TWO-CONDUCTOR ROD
F. D. Mundt 8 Apr. 1971 87 p refs
(Contract W-7405-eng-26)
(Y-1787) Avail: NTIS

Using a coil encircling a coaxial two-conductor rod experimental measurements are made in order to substantiate the validity of the integral form of the solution to this electromagnetic induction problem. A computer program is used to solve the problem with the experimental parameters to obtain theoretical normalized impedance values. Experimental values of normalized impedance are obtained using a precision impedance bridge, and a comparison is made between the experimental and theoretical values. An estimate of the experimental accuracy is made in order to evaluate the accuracy of the theory. It is concluded that the integral method of predicting eddy current response is very effective and quite accurate. It is capable of predicting the normalized inductive component to an accuracy of approximately 0.1 per cent and the normalized resistive component to an accuracy of approximately 1.0 per cent. Author

N71-32441 Minnesota Univ., Minneapolis.
SENSITIVITY ANALYSIS ON NONLINEAR ESTIMATION ALGORITHMS
Ramachandra H. Joisa (Ph.D. Thesis) 1969 194 p
Avail: Univ. Microfilms Order No. 70-15751

The derivation and evaluation of algorithms for error analysis, sensitivity of filtering, and smoothing solutions to nonlinear estimation problems were presented. Modeling errors as well as the ignorance of the input and observation noise parameters were considered. Fixed-interval and fixed-point smoothers were considered in this analysis. From the assumed model for the physical process and the actual process itself, a differential equation was derived for the actual error-covariance matrix of the filtered and smoothed estimates of the nonlinear system, using first order approximations. An upper bound was established for the difference between the actual and the calculated error-covariance matrices for the filtered and smoothed estimates. Sensitivity was defined as a percentage change in the actual error variances for a given change in the parameter considered. The successive linearization algorithm was developed for the sensitivity analysis of the estimates and the problem of convergence was discussed. Dissert. Abstr.

N71-32468*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CURRENT TO MOVING SPHERICAL AND CYLINDRICAL ELECTROSTATIC PROBES
L. E. Wharton (Md. Univ., College Park), and W. R. Hoegy Jun. 1971 9 p refs Submitted for publication
(NASA-TM-X-65639; X-621-71-276) Avail: NTIS CSCL 09C

The current collection characteristics of moving cylindrical and spherical electrostatic probes are evaluated for velocities encountered in earth satellites and planetary probes. Simple asymptotic current formulas are developed for large values of the Mach number and potential. A data reduction technique for determining ion densities from the accelerated ion current is discussed. The current expressions are given in terms of standard functions and recurrence relations, therefore allowing straightforward computer programming of all the probe current formulas. Author

N71-32666 California Inst. of Tech., Pasadena.
TUNNELING IN SCHOTTKY BARRIERS
Gerhard Hans Parker (Ph.D. Thesis) 1970 52 p
Avail: Univ. Microfilms Order No. 70-14846

The tunneling characteristics of metal contacts on n-type CdTe and p-type InAs have been measured. Both the forward and reverse bias characteristics on CdTe are in good agreement with the two-band model for the energy vs. complex momentum relationship. The presence of trapping states increased the magnitude of the tunneling current at low voltage levels by providing a two-step transition. The slope of the forward bias log J vs. V curves for tunneling through the intermediate states was reduced by a factor of 2. The approximate density and energy of the trapping states was calculated from the observed J-V characteristics. The E-k dispersion relation for InAs was also determined and found to be in excellent agreement with the two-band model. Dissert. Abstr.

N71-32712 Maryland Univ., College Park.
FORWARD SCATTERING IN DIELECTRIC TURBULENCE
Ernest Normal Hernandez (Ph.D. Thesis) 1969 76 p
Avail: Univ. Microfilms Order No. 70-14938

An electromagnetic plane wave was studied as it propagated through a slab of a turbulent media. The single scatter or first Born approximation was used. Complete closed forms were obtained for the amplitude and phase fluctuations of the electromagnetic wave at the end of the slab. In the special case of the Gaussian correlation functions these results were compared with the Rytov method. For small transition parameters the two results agreed. An attempt was made to compare the wave equation and the sagittal Born equation. Limiting forms were obtained which closely checked in the above cases. Dissert. Abstr.

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N71-31619# National Bureau of Standards, Washington, D.C.
DEVELOPMENT, TESTING, AND EVALUATION OF VISUAL LANDING AIDS Consolidated Progress Report, 1 Oct.–31 Dec. 1970

1 May 1971 11 p refs
(NBS-10-577) Avail: NTIS

The development, testing, and performance evaluation of visibility meters, airfield lighting and marking, and carrier lighting are reported. Field testing and evaluation of a backscatter visibility meter (shipboard), development of fog detectors, a review of natural horizon sky luminance observations, and transmissometers are included as well as the improvement and field testing of a cable fault locator, airfield lighting maintenance manual reviews, frangible coupling impact tests, static load tests of semiflush lights, photometric measurements of visual approach indicator and lamp lenses, electrical tests of isolating transformers, and the fabrication of a portable runway photometer. J.M.

N71-31623# Federal Aviation Administration, Washington, D.C. Systems Maintenance Service.

SYSTEMS MAINTENANCE PROGRAM EVALUATION CONDUCTED IN THE CENTRAL REGION Summary Report, 10–28 Aug. 1970

Nov. 1970 58 p refs
Avail: NTIS

The results of a comprehensive evaluation of the conduct of programs and activities directly related to or significantly affecting, the maintenance of commissioned airway facilities in the Central Region are set forth. The on-site data collection phase took place during the period August 10 - August 28, 1970. Program information was obtained by direct observation, by interviews, by on-site study of region, area, and sector prepared reports, records, and correspondence, and by postvisit analysis of other documents. The on-site phase encompassed visits of three areas, including Kansas City and ten AF Sectors. It included inspection of 47 facilities. Interviews were held with more than 200 employees including technicians, supervisors, and management officials at all levels of the AF organization. Discussions were held with area managers and the regional director as well as with air traffic controllers, flight inspectors, and other key officials in AT, FS, BU, PT, and other organizations. Author

N71-31693# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

COLLISIONLESS PLASMA FLOW AROUND A CYLINDER IN VIEW OF APPLICATIONS TO IONOSPHERIC PROBES [ECOULEMENT DE PLASMA SANS COLLISIONS AUTOUR D'UN CYLINDRE EN VUE D'APPLICATIONS AUX SONDES IONOSPHERIQUES]

Gerard Fournier (Ph.D. Thesis–Paris Univ.) 1971 83 p refs In FRENCH; ENGLISH summary
(ONERA-Publ-137) Avail: NTIS

For the steady state and without magnetic field, an iterative numerical calculation method is proposed (analog network, then trajectories on a computer). As compared to previous theories, restrictions on the choice of all parameters are lifted and the electrons are not taken into account in the Maxwell–Boltzmann equilibrium; this shows that, for probe potentials slightly higher than the plasma potential, the sheath structure does not exist any more. In the wake, the existence of particular phenomena appears: potential sink, two-beam structure. The currents on the probe are examined and a complete characteristic is computed, as well as the evolution of the electrostatic drag. These results are compared with experimental results previously obtained in the ionosphere and in simulation, as well as the simulation experiments. It is shown that the ion current decreases between the plasma potential and the beam stagnation potential, and that the probes whose diameter is too large compared with the Debye length, do not allow the measurement of the electron temperature in hypersonic flight. Author (ESRO)

N71-31694# Von Karman Inst. for Fluid Dynamics, Rhode Saint-Genese (Belgium).

TRAJECTORY READOUT BY PROGRESSIVE ECLIPSING OF A PHOTO-ELECTRIC SCREEN TO OBTAIN AERODYNAMIC FORCE DATA FROM FREE-FLIGHT WIND TUNNEL MODELS

P. L. Clemens May 1971 30 p refs
(VKI-TN-72) Avail: NTIS

A newly designed photoelectric system has been used to measure aerodynamic forces on models in a longshot wind tunnel. The system makes use of a periodically interrupted light beam which is progressively eclipsed by the free-flight model. Electronic readout is provided. In early testing, the drag coefficient for a sharp conical model of 9 deg semiangle has been measured at zero attack angle and at a Mach number of 15 and a Reynolds number of 21 x 1,000,000 per m. Measurements by this method are compared with those from a previously used shadowgraph technique. The latter produce values of drag coefficient either higher (12.8%) or lower (11.1%) depending upon which of the two data reduction methods is applied. The value of C sub D given by the photoelectric system agrees, within 6.29%, with that given by Talbot's method. Author (ESRO)

N71-31722# Army Engineer Waterways Experiment Station, Vicksburg, Miss.

DYNAMICS OF WHEELED VEHICLES. REPORT 3: A STATISTICAL ANALYSIS OF TERRAIN-VEHICLE SPEED

Newell R. Murphy, Jr. (M.S. Thesis–Miss. State Univ.) Apr. 1971 11 p refs
(AD-723405; AEWES-TR-M-68-1-3) Avail: NTIS CSCL 13/6

The problem of the study was to investigate the validity and practicality of applying spectral density methods and the inherent statistics to the problem of describing terrain roughness and vehicle responses in terms of vehicle speed. Author (GRA)

N71-31766# Massachusetts Inst. of Tech., Cambridge.

SUMMARY OF RESEARCH AT MIT ON TECHNOLOGY FOR HIGH SPEED GROUND TRANSPORT Progress Report, 16 Nov. 1967–15 Sep. 1969

William W. Seifert 31 Aug. 1970 85 p refs
(Contract DOT-C-85-65)
(PB-198015; FRA-RT-71-71) Avail: NTIS CSCL 13F

Contents: Systems analysis and vehicle control; Vehicle suspension systems; Propulsion; Vehicle and tube aerodynamics; Some guideway considerations. GRA

N71-31789# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Abteilung Regelsysteme.

QUALIFICATION OF A HFB-320 HANSA AND A PIAGGIO P 149 D FOR INFLIGHT SIMULATION FOR THE APPROACH OF A COMBAT AIRCRAFT WITH HIGH WING LOADING [EIGNUNG EINER HFB-320 HANSA UND EINER PIAGGIO P 149 D ALS FLIEGENDER SIMULATOR FUER DEN LANDEANFLUG EINES KAMPFFLUGZEUGES HOHER FLAECHENBELASTUNG]

Bernd Uhrmeister 1971 83 p refs In GERMAN; ENGLISH summary
(DLR-FB-71-06) Avail: NTIS; DFVLR Porz: 27 DM

The qualification of a HFB-320 Hansa and a Piaggio P 149 D as an inflight simulator for the approach of a heavy combat aircraft are compared. The principle of the modification being the response feedback technique. The validity of the simulation with actuators both lagging and being free from lag, was investigated by means of periods of time. A discussion follows about the simulator's sensitivity against lagging thrust and lagging actuators as well as errors in the derivatives of the basic aircraft. Simulated

landing approaches were performed in a fixed base simulator to gain insight into the pattern of motion and steering progress and required control deflections of the inflight simulator. Author (ESRO)

N71-31812# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Luftsaugende Antriebe.
THE TEST SECTION OF THE WIND TUNNEL FOR JET PROPULSION RESEARCH OF THE DFVLR AT TRAUEN [DIE MESSTRECKE DES WINDKANALS FUER ANTRIEBSFORSCHUNG DER DFVLR IN TRAUEN]
Reiner Lindemann and Egbert Riester Apr. 1971 45 p refs in GERMAN; ENGLISH summary
(DLR-MITT-71-08) Avail: NTIS; DFVLR Porz: 11.50 DM

After completion of the wind tunnel for jet propulsion research, its performance, and application possibilities are investigated. The facility is described and the range of its simulation capability is shown. The accuracy of the flow distribution in the test section is investigated along the tunnel axis and in several cross sections. The necessary adjustment data of the tunnel components, especially of those of the diffuser arrangement, are determined. With these data it is possible to consider the combination of the tunnel with the hot water ejector performance. Author (ESRO)

N71-31813# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
PROPELLER TESTS IN THE LARGE SONIC WIND TUNNEL OF MODANE-AVRIEUX [ESSAIS D'HELICES DANS LA GRANDE SOUFFLERIE SONIQUE DE MODANE-AVRIEUX]
Alain Masson 1970 37 p refs In FRENCH; ENGLISH summary
(ONERA-NT-161) Avail: NTIS

The installation designed by ONERA for investigations on full-scale or large-scale models of conventional aircraft or convertiplane propellers in the large sonic wind tunnel at the Modane–Avrieux Test Center is described. Some examples of tests carried out and typical results obtained illustrate the use capability of the equipment, which is also suitable for helicopter rotor tests. Author (ESRO)

N71-31814# Grandes Soufflerles de Modane-Avrieux (France).
OPERATION OF THE MODANE-AVRIEUX AEROTHERMODYNAMIC TEST CENTER [EXPLOITATION DU CENTRE D'ESSAIS AEROTHERMODYNAMIQUES DE MODANE-AVRIEUX]
Marcel Pierre and Guy Fasso Paris ONERA 1971 33 p In FRENCH; ENGLISH summary
(ONERA-NT-181) Avail: NTIS

The technical features of the facilities are briefly reported: four wind tunnels, the velocity of which range from 10 m/sec up to Mach 8 (eventually Mach 12), and auxiliary installations. The operational conditions of these test facilities are described: relations with customers, internal organization, technical development. The suitability of the Modane wind tunnels to the present aerospace needs is considered by a survey of the various test categories asked for: aerodynamics, propulsion, operational tests. The improvements foreseen for these facilities are indicated. Finally, the need for new industrial wind tunnels is examined. Author (ESRO)

N71-31883# Smith (Wilbur) and Associates, Columbia, S.C.
SOUTH CAROLINA STATEWIDE AVIATION AND AIRPORTS PLAN
Nov. 1970 290 p refs Prepared for South Carolina State Planning and Grants Div., Columbia
(PB-197728; SC-40-0014-0260) Avail: NTIS CSCL 01E

The report outlines a statewide system of public use airports to accommodate the needs for air carriers and general aviation in South Carolina to the year 1990. A short-term plan to meet the demands to 1975 outlines immediate needs for upgrading 39 airports and removing general aviation from Charleston Municipal Air Force Base. The long term plan to 1990 would add several general aviation airports, relocate the North Myrtle Beach Airport and propose a regional airport in the Pee Dee area. Long range plans beyond 1985 recommend the addition of VSTOL airports as required. Emphasis was placed on the need for an integrated intermodal transportation system compatible with new types of aircraft, new modes of transportation and the ever changing location of industry. The future utilization of McIntire as a general aviation airport for Richland County and possible back-up air carrier facility for the Columbia Metropolitan Airport is discussed. Also such a facility could be considered, along with other east coast locations for accommodating international flights, after 1990. Author (GRA)

N71-31894# ARO, Inc., Arnold Air Force Station, Tenn.
AN INVESTIGATION OF SEVERAL SLOTTED WIND TUNNEL WALL CONFIGURATIONS WITH A HIGH DISC LOADING V/STOL MODEL Final Report, 1 Jul. 1966–30 Jun. 1970
T. W. Binion, Jr. AEDC May 1971 66 p refs
(Contract F40600-71-C-0002)
(AD-723294; AEDC-TR-71-77) Avail: NTIS CSCL 14/2

The investigation reported herein is the experimental portion of a unified theoretical and experimental search for a slotted wind tunnel wall configuration with minimal interference for conventional and V/STOL models. It is shown that theory and experiment are in excellent agreement for the classical case provided an appropriate expression is used to relate the wall geometry to the boundary condition. Classical data correction equations are not appropriate for the V/STOL case, however. An additional term, not predicted by theory, is needed to account for changes in the jet wake. Geometric parameters which influence the wall interference quantities are indicated. Wall configurations are shown which will produce interference-free force data to a jet-to-free-stream velocity ratio of 4.5. Author (GRA)

N71-31951# Deutsche Gesellschaft fuer Luft- und Raumfahrt, Cologne (West Germany).
FLIGHT MECHANICAL SIMULATION, GROUND BASED OR IN-FLIGHT ? [FLUGMECHANISCHE SIMULATION, AM BODEN ODER IN DER LUFT ?]
May 1971 253 p refs In GERMAN; ENGLISH summary Proc. of the DGLR Symp., Duesseldorf, 4 Dec. 1970
(DLR-MITT-70-29) Avail: NTIS; ZLDI Munich: 53.15 DM

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4. FLIGHT MECHANICAL TAKEOFF AND LANDING INVESTIGATIONS OF A VTOL AIRCRAFT WHEN USING DIFFERENT CONTROL SYSTEMS IN HOVERING FLIGHT H. Kolar (Messerschmitt-Boelkow-Blohm) and G. Schneider (Messerschmitt-Boelkow-Blohm) p 71–112 refs (See N71-31955 19-11)

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8. THE IN-FLIGHT SIMULATOR HFB 320 HANSA: STATE-OF-THE-ART AND PLANNING A. Pietrass (DFVLR, Oberpfaffenhofen) p 211-235 refs (See N71-31959 19-11)

9. V/STOL TECHNIQUE AS AN APPLICATION FIELD OF IN-FLIGHT SIMULATION K. Janik (Messerschmitt-Boelkow-Blohm) p 237-253 refs (See N71-31960 19-02)

N71-31952# Vereinigte Flugtechnische Werke-Fokker G.m.b.H., Bremen (West Germany).

APPLICABILITY OF FLIGHT SIMULATORS WITHOUT VISUAL OR MOTION CUES FOR THE PILOT [VERWENDBARKEIT VON FLUGSIMULATOREN OHNE SICHT- UND BEWEGUNGSEINDRUECKE DES PILOTEN]

R. Schweinfurth *In* DGLR Flight Mech. Simulation, Ground Based or In-flight May 1971 p 9-39 refs In GERMAN (See N71-31951 19-11)

Avail: NTIS; ZLDI Munich: 53.15 DM

The pilot's role in cockpit simulation, the requirements of the simulator, and the validity of the factors influencing the simulation, are treated. The applicability of the fixed seat simulator in investigations of handling quality is demonstrated by comparisons of simulation and flight test. ESRO

N71-31953# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugfuehrung.

THE INFLUENCE OF MOTION CUES ON PILOT ERRORS IN SIMULATED ILS APPROACHES [DER EINFLUSS VON BEWEGUNGSEINDRUECKEN AUF FUEHRUNGSFEHLER BEI SIMULIERTEN ILS-ANFLUEGEN]

F. Erdmann and R. Dierke *In* DGLR Flight Mech. Simulation, Ground Based or In-flight May 1971 p 41-48 refs In GERMAN (See N71-31951 19-11)

Avail: NTIS; ZLDI Munich: 53.15 DM

The flight simulator at DFVLR-Braunschweig is briefly described (digital simulation, gust modes, motion simulation with three-axis system). A short description is given of the test results of using this simulator for ILS-approaches (Instrument Landing Systems) with and without motion. ESRO

N71-31954# Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn (West Germany). Hauptabteilung Wehrtechnische Studien.

EFFICIENCY OF A FLIGHT SIMULATOR FOR SPECIAL MISSIONS [UEBER DIE WIRKSAMKEIT EINES FLUGSIMULATORS FUER SPEZIELLE MISSIONEN]

H. M. Franke and P. Sepp *In* DGLR Flight Mech. Simulation, Ground Based or In-flight May 1971 p 49-69 refs In GERMAN; ENGLISH summary (See N71-31951 19-11)

Avail: NTIS; ZLDI Munich: 53.15 DM

The necessity of simulation during the early phase of design for the determination of the proper mission and the parameters that describe the vehicle is pointed out. A comparison of different simulation techniques (all digital simulation, fixed base simulation, and in-flight simulation) is made with respect to their relevance, flexibility, and cost. The installations of a universal simulation facility are described. A flight simulator is presented where special attention is given to sight simulation. Finally an example of a complex simulation problem is introduced. Author (ESRO)

N71-31955# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Unternehmensbereich Flugzeuge-Entwicklung.

FLIGHT MECHANICAL TAKEOFF AND LANDING INVESTIGATIONS OF A VTOL AIRCRAFT WHEN USING DIFFERENT CONTROL SYSTEMS IN HOVERING FLIGHT [FLUGMECHANISCHE START- UND LANDEUNTERSUCHUNGEN EINES VTOL-FLUGZEUGES BEI VERWENDUNG VERSCHIEDENER STEUERSYSTEME IM SCHWEBEFLUG]

H. Kolar and G. Schneider *In* DGLR Flight Mech. Simulation, Ground Based or In-flight May 1971 p 71-112 refs In GERMAN; ENGLISH summary (See N71-31951 19-11)

Avail: NTIS; ZLDI Munich: 53.15 DM

Uses and quality of various control systems (attitude and speed control) during takeoff and landing of VTOL aircraft are determined. A yardstick for these two types of control was prepared based upon pilots' assessments and the measured data which were statistically analyzed. Various external conditions such as visibility and gusts, including a variation in the thrust-weight ratio were also treated in the investigation. Author (ESRO)

N71-31956# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).

FLIGHT MECHANICAL SIMULATION FROM THE USER'S POINT OF VIEW [FLUGMECHANISCHE SIMULATION AUS DER SICHT DES BENUTZERS]

H. Friedrich *In* DGLR Flight Mech. Simulation, Ground Based or In-flight May 1971 p 113-128 In GERMAN (See N71-31951 19-11)

Avail: NTIS; ZLDI Munich: 53.15 DM

Taking two examples, a project study of a STOL transport aircraft and the Dornier 31 development, the experiences of using a simulator with fixed cockpit are discussed. The simulation of the Do-31 on a simulator allowing 6 degrees of cockpit freedom at NASA Ames Research Center, is described. The possible new developments, resulting from the practical work, are discussed. ESRO

N71-31957# Vereinigte Flugtechnische Werke-Fokker G.m.b.H., Bremen (West Germany).

EVALUATION OF IN-FLIGHT SIMULATION USING A HELICOPTER OF VARIABLE STABILITY AND CONTROL WITH REGARD TO ITS USE AS AN AUXILIARY IN AIRCRAFT DEVELOPMENT [AUSWERTUNG VON FREIFLUGSIMULATIONEN MIT EINEM HUBSCHRAUBER VARIABLER STABILITAET UND STEUERBARKEIT IM HINBLICK AUF SEINE EIGNUNG ALS HILFSMITTEL BEI DER FLUGZEUGENTWICKLUNG]

H. Schmidtlein *In* DGLR Flight Mech. Simulation, Ground Based or In-flight May 1971 p 129-168 refs In GERMAN (See N71-31951 19-11)

Avail: NTIS; ZLDI Munich: 53.15 DM

A helicopter Bell 47-G was used to simulate the flight characteristics of a VFW/Fokker V/STOL flying platform to see whether its properties are well enough transmitted to the pilot, and also to study the pilot's reaction in case of vertical takeoff control system breakdown, and to optimize the maneuverability of the vertical takeoff aircraft by nonlinear positioning. ESRO

N71-31958# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.

CONTRIBUTION TO THE SIMULATION MARGIN AND PARAMETER SENSITIVITY OF IN-FLIGHT SIMULATORS [BEIT RAEGE ZUR SIMULATIONSBREITE UND PARAMETEREMPFINDLICHKEIT VON FLIEGENDEN SIMULATOREN]

B. Uhrmeister *In* DGLR Flight Mech. Simulation, Ground Based or In-Flight May 1971 p 169–210 refs In GERMAN (See N71-31951 19-11)

Avail: NTIS; ZLDI Munich: 53.15 DM

A formula for calculating the simulation margin and the parameter sensitivity of in-flight simulation is derived from the root locus analysis of a control system. The relation between the flight characteristics of the original aircraft and its model and the simulation margin are discussed. ESRO

N71-31959# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.

THE IN-FLIGHT SIMULATOR HFB 320 HANSA: STATE-OF-THE-ART AND PLANNING [DER FLIEGENDE SIMULATOR HFB 320 HANSA: STAND UND PLANUNG]

A. Pietrass *In* DGLR Flight Mech. Simulation, Ground Based or In-Flight May 1971 p 211–235 refs In GERMAN; ENGLISH summary (See N71-31951 19-11)

Avail: NTIS; ZLDI Munich: 53.15 DM

The auxiliary equipment necessary for the in-flight simulator has been combined in several subsystems, connected via specific interfaces. Subsystems are electrical regulating system, command system of the simulated pilot with load simulation, display system of the simulated pilot, onboard computer and measuring equipment. These subsystems will be ready in 1971. ESRO

N71-32278*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

ALUMINIZING OF THE 7.01-m COLLIMATING MIRROR FOR THE JPL 7.62-m SPACE SIMULATOR

Eugene W. Noller and Robert E. Frazer 15 Jul. 1971 39 p refs

(Contract NAS7-100)

(NASA-CR-119688; JPL-TM-33-485) Avail: NTIS CSCL 14B

The modification of the JPL 7.62-m (25-ft) space simulator required the aluminizing of a 7.01-m (23-ft) collimating mirror. The classical aluminizing technique of vaporizing aluminum from tungsten filaments was scaled up from previous experience in aluminizing the JPL 3.05-m (10-ft) collimating mirror. Several techniques were evaluated and discarded in determining the best aluminizing method. An evaporation system was developed using three electron-beam guns magnetically focused on a single crucible with a second set of coils producing a variable magnetic field to distribute the evaporated aluminum. The mirror was exposed to the aluminum vapor through a large shutter. For thickness control, a crystal microbalance with temperature compensation was used with a digital display. Author

N71-32481# National Center for Atmospheric Research, Boulder, Colo.

NCAR RESEARCH AND FACILITIES PROGRAMS Annual Report, 1970

May 1971 143 p Sponsored by NSF

Avail: NTIS

The research projects, facility development, and organizational aspects of the National Center for Atmospheric Research are presented. Subjects discussed are: (1) research aviation facility, (2) scientific balloon facility, (3) computing facility, (4) field observing facility, (5) global atmospheric measurements program, and (6) research systems facility. Author

N71-32728# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Teoreticheskoi i Eksperimentalnoi Fiziki.

SEVERAL ASPECTS OF THE DESIGN AND THE CALCULATION OF ITEP 2-METER LIQUID HYDROGEN BUBBLE CHAMBER

A. M. Stepanov 1970 22 p refs In RUSSIAN; ENGLISH summary

(NP-18787) Avail: AEC Depository Libraries

The designs and the calculations for the chamber body, expansion system, vacuum tank, and nitrogen shielding are discussed. Author (NSA)

N71-32730# National Bureau of Standards, Boulder, Colo. Cryogenics Div.

CRYOGENIC FLOW RESEARCH FACILITY PROVISIONAL ACCURACY STATEMENT

J. W. Dean, J. A. Brennan, D. B. Mann, and C. H. Kneebone Jul. 1971 36 p refs

(NBS-TN-606) Avail: SOD $0.45

The National Bureau of Standards and the Compressed Gas Association have jointly sponsored a research program on cryogenic flow measurement. A cryogenic flow research facility was constructed and was first used to evaluate commercially available cryogenic flowmeters operating with liquid nitrogen on a positive displacement principle. The performance of the flow facility was simultaneously being evaluated during the meter tests. The performance evaluation of the flow facility is reported. An accuracy statement is given for both totalized mass and volumetric flow. Author

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N71-31663# Von Karman Inst. for Fluid Dynamics, Rhode Saint-Genese (Belgium).

FREE-FLIGHT STATIC STABILITY MEASUREMENTS OF CONES IN HYPERSONIC FLOW

K. R. Enkenhus, S. Culotta, and P. Krogmann Jan. 1970 78 p refs

(VKI-TN-68) Avail: NTIS

Free-flight tests of 15 deg and 9 deg half-angle cones have been carried out in the VKI longshot free piston hypersonic tunnel at 15 and 23 M. The motion of the models was recorded by exposing successive images onto one photographic plate by use of a multiple spark light source. The lift and drag coefficients were calculated from the analysis of the trajectory using an IBM 1130 computer. The force coefficients agreed well with values obtained from force balance measurements M = 20.3 in a helium blowdown wind tunnel, but differed somewhat from Newtonian predictions. Author (ESRO)

N71-31688# Brussels Univ. (Belgium). Inst. of Applied Mechanics.

ANALYSIS OF AN AIR CUSHION WITH PERIPHERAL JET HOVERING OVER WATER [LE MECANISME DU COUSSIN D'AIR A JET PERIPHERIQUE AU POINT FIXE SUR L'EAU]

A. Jaumotte, A. Kiedrzynski, P. Spehl, and P. Waterkeyn 1971 41 p refs In FRENCH

(NT-27-1971) Avail: NTIS

Observations made on both the experimental air cushion

vehicle of Brussels University and a two dimensional mock-up have led to a model of peripheral jets. A theory is developed for nonviscous jets from which all parameters of the jet including form can be determined from independent variables. The theory is compared with experimental results. From the model secondary effects due to viscosity are discussed. ESRO

N71-31689# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
NONLINEAR STABILITY THEORY OF LAMINAR FLOWS [THEORIE NON LINEAIRE DE LA STABILITE DES ECOULEMENTS LAMINAIRES]
Gerard Iooss (Ph.D. Thesis - Paris Univ.) 1971 120 p refs In FRENCH; ENGLISH summary
(ONERA-Publ-136) Avail: NTIS

A weakly nonlinear theory of the stability of laminar flows is developed. The stability criterion yielded by the linearization of the system of equations is justified. In the case of "exchange of stabilities", the unsteady and steady problems are shown to be closely related. In the weakly supercritical regime, conditions are found which insure that the solution tends, for t approaching limit of infinity, towards a steady solution different from the basic one. A thorough study is made, in this case, of the nonuniqueness of steady solutions. Lastly, all the relevant assumptions made in this case are verified for the Benard's problem. In the case when the most unstable eigenmode oscillates at the neutral stability, a study is made of the conditions under which, in the weakly supercritical case, the flow tends, for t approaching the limit of infinity, towards a periodic flow with constant amplitude. Author (ESRO)

N71-31706# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
BLADE PROFILE CALCULATION THROUGH A GRAPHIC VISUALIZATION CONSOLE [CALCUL DE PROFILS D'AUBES DE COMPRESSEUR A L'AIDE D'UNE CONSOLE DE VISUALISATION GRAPHIQUE]
Ginette Mortier and Claude Lecomte 1971 23 p In FRENCH; ENGLISH summary
(ONERA-NT-176) Avail: NTIS

A variant of the hodograph method is briefly presented, applied on the calculation of the compressible flow on a compressor blade cascade in Chaplygin fluid. This method leaves two arbitrary complex parameters; these are adjusted in order to obtain a hodograph, and thence a satisfactory profile and velocity distribution. This is done with the help of a visualization computer console permitting first to display the results as curves (hodograph, profile), and then to enter new values of the parameters before restarting the calculation. Author (ESRO)

N71-31740# Advanced Technology Center, Inc., Dallas, Texas.
EFFECTS OF DISTRIBUTED INJECTION OF POLYMER SOLUTIONS ON TURBULENT DIFFUSION Interim Report
R. R. Walters and C. S. Wells Mar. 1971 71 p refs
(Contract N00014-69-C-0214)
(AD-723860) Avail: NTIS CSCL 20/4

Part of an extensive experimental investigation of the mechanics of turbulent diffusion is described for uniformly distributed injection of a polymer solution through a porous wall adjacent to a fully-developed turbulent pipe flow of water. The diffusion data were obtained over an active porous wall section and throughout the region immediately downstream of the porous wall. The previously recorded wall friction anomalies recorded in the region of distributed polymer injection are shown to depend on the viscosity of the resulting polymer solutions near the wall associated with reduced diffusion. Empirical diffusion coefficients give a quantitative determination of the effect of the polymer in reducing turbulent diffusion for the present case. The transitional sublayer was identified from these data as the boundary layer region requiring polymer to effect wall friction reduction. Author (GRA)

N71-31743# Naval Scientific and Technical Information Centre, Orpington (England).
HYDRAULIC RESISTANCE IN A TWO PHASE FLOW
A. V. Soloviev Mar. 1971 14 p refs Transl. into ENGLISH from Khim. Prom. (Leningrad), no. 8, 1966 p 601-604
(AD-723590; NSTIC-29485; NSTIC-TRANS-2027) Avail: NTIS CSCL 13/11

When considering the problem of intensifying mass-transmission processes, the hydrodynamic problem of the joint movement of a gas stream and a liquid film wetting the inner wall of a cylindrical channel assumes special significance. In particular, there is the important question of the hydraulic resistance of such a two phase system during change of average speeds and physical characteristics of the interacting phases. Experimental data on hydraulic resistance of condenser tubes in conditions of the phases flowing in the same direction and oposite directions with constant wetting thickness, shows that the resistance of a two phase system has a number of pecularities which testify to the qualitative difference between this type of flow and the normal single phase flow. Thus, at a certain critical gas flow speed corresponding to the change from opposite flow to unidirectional flow, a sharp rise in resistance is observed. With further increase in speed of the gas phase the resistance falls, reaches a certain minimum value and then increases again. In this way every fixed wetting has a clearly defined minimum of fall of pressure. The existence of a flow region where with the increase of gas speed resistance falls seems at first sight to contradict natural laws. The apparent contradiction is explained by solving the equation of motion in the liquid phase. Author (GRA)

N71-31751# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
FLOWFIELD SURVEYS IN THE LEADING EDGE REGION OF A SHARP FLAT PLATE Final Scientific Report, Jan. 1970-Jan. 1971
Robert J. Vidal, Gordon E. Merritt, and John A. Bartz Feb. 1971 42 p refs
(Contract F44620-70-C-0039)
(AD-723328; CAL-AF-2919-A-2, AFOSR-71-0828TR) Avail: NTIS CSCL 20/4

Data obtained in the hypersonic viscous shock layer of a sharp flat plate are presented. These were obtained with speed-ratio probes operating under free-molecule conditions, and the measurements are interpreted with the theory for free-molecule flows as the local speed-ratio, and the local value of the product. These show that the initial disturbance from the plate extends about twelve ambient mean-free-paths ahead of the leading edge. In the immediate vicinity of the leading edge (vertically less than five ambient mean-free-paths) the disturbance causes a decrease in the speed ratio, and no change in the product. Beyond five mean-free-paths from the surface, the disturbance produces a simultaneous increase in the local value of the product and a decrease in speed-ratio. The data obtained within the viscous shock layer show there is a well-defined boundary where the measurements of the local value of the product show a pronounced decrease. This is identified as the boundary where viscous heating dominates, and its location is found to be in good agreement with the position of the shock wave determined from low-density schlieren observations. This is because viscous heating in the flowfield produces a stronger density gradient than the upstream compression process. Lateral profiles of the speed-ratio are in good agreement with other temperature data. Author (GRA)

N71-31763# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Mechanical Engineering.
THE AERODYNAMIC CHARACTERISTICS OF A VEHICLE

TRAVELING IN A TUNNEL OF FINITE LENGTH Final Report, Oct. 1969 – Oct. 1970
S. William Gouse, Jr. and Ezzatt Wali Oct. 1970 93 p
(Contract DOT-FR-0007)
(PB-197871; CMU-59095-1) Avail: NTIS CSCL 20D

The dependence of the drag coefficient of a vehicle, moving coaxially with uniform linear velocity through a solid wall tube of finite length, on the ratio of the relative velocity of the induced fluid pushed ahead of the vehicle to the absolute velocity of the vehicle was investigated. An apparatus was built with a vertical acrylic test tube, 25 ft. high and 1.732 in. inside diameter. The tube was provided with water flow of different negative and positive pressure gradients. Drop tests were conducted using models with smooth surface, in the form of cylinders with a streamlined nose and conical tail. The mode of variation of the drag coefficient with the velocity ratio at model Reynolds number of 100,000 was experimentally established for the test parameters. Author (GRA)

N71-31791# National Aerospace Lab., Amsterdam (Netherlands).
THE APPLICABILITY OF FIRST AND SECOND ORDER THEORY FOR THE DETERMINATION OF SUBCRITICAL PRESSURE DISTRIBUTIONS ON NON-LIFTING AEROFOILS
H. I. Baurdoux and G. J. Schipholt Jun. 1969 21 p refs
Sponsored by the Min. of Defence of the Neth.
(NLR-TR-69028-U) Avail: NTIS

Pressure distributions are calculated for a number of two dimensional nonlifting symmetrical quasi-elliptical airfoils with the uniformly valid first order theory and Gretler's second order theory. The results have been compared with exact solutions for incompressible and compressible subsonic flow. For nonelliptical nose shapes the results of the approximate theories may differ considerably from exact results. Author (ESRO)

N71-31896# Virginia Polytechnic Inst., Blacksburg.
DEVELOPMENT OF A NUMERICAL METHOD TO SOLVE THE THREE-DIMENSIONAL COMPRESSIBLE LAMINAR BOUNDARY-LAYER EQUATIONS WITH APPLICATION TO ELLIPTICAL CONES AT ANGLE OF ATTACK
J. J. McGowan, III and R. T. Davis Wright-Patterson AFB, Ohio ARL Dec. 1970 118 p refs
(Contract F33615-70-C-1015)
(AD-723280; ARL-70-0341) Avail: NTIS CSCL 12/1

A method for solving general compressible three-dimensional boundary-layer flows is developed. The equations are initially placed in a Crocco-type form which makes use of similarity variables. A general solution tehcnique which employs an implicit finite-difference scheme that is stable for negative transverse velocities is developed. As an application of the method, solutions for 10 degree vertical half-angle elliptical cones of varying ellipticity ratios at up to 8 degree angle of attack at a Mach number of 7.95 are presented. Skin friction and heat-transfer-rate distributions are presented for all cases. Good agreement is found with the experimental data of Tracy for heat-transfer rates on circular cones at angle of attack. Author (GRA)

N71-31935# Aerospace Research Labs, Wright-Patterson AFB, Ohio.
EXPERIMENTAL INVESTIGATION OF THE MAXIMUM MACH NUMBER IN A CONFINED COMPRESSIBLE VORTEX Final Report
Robert Poplawski and Howard L. Toms, Jr. Jan. 1971 72 p refs
(AD-723279; ARL-71-0018) Avail: NTIS CSCL 20/4

The work presents experimental results obtained with reverse flow vortex chambers which indicate the maximum experimental tangential Mach number is below 1.60. Helium, carbon dioxide and air were used in the investigation. Tests were conducted over a range of inlet pressures and temperatures, exhaust chamber back pressures, mass flow splits, exhaust throat areas, and chamber volume. Calculations, based on the experimental data, showed that the maximum rotational velocity can be increased by nearly 300% by changing gases or decreasing the exhaust throat area even though the maximum Mach number remains essentially the same. Tests also indicated the possibility of two peaks as the mass flow split is varied. However, additional testing must be accomplished to verify the two peaks. Author (GRA)

N71-31943# Hydronautics, Inc., Laurel, Md.
THE MOTION OF TURBULENT VORTEX-PAIRS IN HOMOGENEOUS AND DENSITY STRATIFIED MEDIA
Marshall P. Tulin and Josef Schwartz Apr. 1971 57 p refs
(Contract N00014-70-C-0345)
(AD-723184; Rept-231-15) Avail: NTIS CSCL 20/4

A theory for the motion of two-dimensional turbulent vortex pairs in homogeneous media has been developed based on separate velocity scaling of the internal and external flow fields involved in the motion and taking into account variations in volume, circulation, momentum, and energy. Based on the results obtained from this theory, a simplified theory is derived to deal with the rising motion of turbulent vortex pairs in stratified media. The theoretical results are compared with systematic experimental observations. Author (GRA)

N71-31997# Naval Ship Engineering Center, Philadelphia, Pa.
TOWARD A CONSTANT COEFFICIENT OF DISCHARGE FROM A NOZZLE VIA NEW PRESSURE TAP LOCATIONS
David R. Keyser 10 Mar. 1971 109 p refs
(AD-722321; NAVSECPHILADIV-A-900) Avail: NTIS CSCL 20/4

Two improvements were made to a long radius flow nozzle which could make these differential pressure head class elements more useful to the Navy. These were modifications to the locations of the downstream pressure taps resulting in improved discharge coefficients. The pipe Reynolds number ranged between 20,000 and 500,000 while testing the 0.4 Beta ratio nozzle. The first modification resulted in a nearly constant coefficient of about 0.985 over the whole range of Reynolds number. The second resulted in a constant coefficient of about 0.996 for pipe Reynolds numbers below 62,500 down to 20,000. The nearly constant discharge coefficient greatly facilitates the application of these elements to Naval shipboard piping--for example, as sensors for fuel oil metering in automatic combustion control systems. Author (GRA)

N71-31998# Pennsylvania State Univ., University Park. Ordnance Research Lab.
THE INFLUENCE OF SURFACE IRREGULARITIES ON CAVITATION: FIELD STUDY AND LIMITED CAVITATION NEAR WIRE SCREEN ROUGHNESS
William T. Bechtel, II (M.S. Thesis) 26 Feb. 1971 153 p refs
(Contract N00017-70-C-1407)
(AD-723843; TM-71-47) Avail: NTIS CSCL 20/4

Two sizes of wire screen roughness height (0.015 and 0.046 inches) have been experimentally investigated to determine their wall shear stress and cavitation characteristics. The wall shear stress was computed from the boundary layer velocity profile utilizing the law of the wall. Desinent cavitation numbers were obtained visually with varying free stream velocity. The maximum range in velocity was from 30 to 46 feet per second. The maximum range in velocity was from 30 to 46 feet per second. The linear relationship between cavitation inception and wall shear stress, characteristic of distributed roughness, was verified. An investigation was also made of real surface roughness to determine the relative size of real irregularities, what types exist and where they occur, what types are isolated or distributed, and what types may contribute most to the occurrence of cavitation. The results of this study will be applied in a program to determine the tolerance on real surface roughness for a specified cavitation performance. Author (GRA)

N71-31999# Naval Ordnance Lab., White Oak, Md.
VERTICAL WATER ENTRY OF CONES
John L. Baldwin 11 Feb. 1971 76 p refs
(AD-723821; NOLTR-71-25) Avail: NTIS CSCL 16/3

An experimental investigation of the vertical water-entry deceleration of various cone nose shapes, and a data-reduction method for the resulting information are described. Total drag coefficient, and added mass coefficient are determined as functions of penetration distance. These functions are shown to be independent of entry velocity and model mass over a wide range of test conditions. A method of predicting the accelerations experienced by the vertical water entry of an arbitrary cone is described. Author (GRA)

N71-32116# Argonne National Lab., Ill.
EXPERIMENTAL STUDY OF A GAS JET PENETRATING A LIQUID COOLANT AND IMPINGING ON A HEATED SURFACE
B. M. Hoglund, R. P. Anderson, and L. Bova Mar. 1971 42 p
(Contract W-31-109-eng-38)
(ANL-7734) Avail: NTIS

An experimental study of temperature transients induced in a heated wall as a result of a gas jet penetrating the coolant stream and impinging upon the wall is described. The experiment was performed in a water cooled, electrically heated, rectangular flow channel. The test section was designed to allow a fixed volume of gas to be discharged through an orifice and impinge on the opposite wall. Thermocouples measured the resulting wall temperature transients. Transient pressures and flow rates were measured, and high speed motion pictures of the resulting gas jets and flow transients were obtained. It was concluded that an impinging gas jet is unlikely to produce failure in an adjacent fuel pin at the point of impingement. Author (NSA)

N71-32164*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
NUMERICAL SOLUTION OF THE EQUATIONS FOR COMPRESSIBLE LAMINAR, TRANSITIONAL, AND TUBULENT BOUNDARY LAYERS AND COMPARISONS WITH EXPERIMENTAL DATA
Julius E. Harris Washington Aug. 1971 85 p refs
(NASA-TR-R-368; L-7660) Avail: NTIS CSCL 20D

A numerical method for solving the equations for either planar or axisymmetric flows is presented. The fully developed turbulent region is treated by replacing the Reynolds stress terms with an eddy viscosity model. The mean properties of the transitional boundary layer are calculated by multiplying the eddy viscosity by an intermittency function based on the statistical production and growth of the turbulent spots. A specifiable turbulent Prandtl number relates the turbulent flux of heat to the eddy viscosity. A three-point implicit finite difference scheme is used to solve the system of equations. The momentum and energy equations are solved simultaneously without iteration. Numerous test cases are compared with experimental data for supersonic and hypersonic flows; these cases include flows with both favorable and mildly unfavorable pressure gradient histories, mass flux at the wall, and transverse curvature. Author

N71-32187# Purdue Univ., Lafayette, Ind. Project Squid Headquarters.
TRAJECTORIES OF SHOCK-WAVE AND CONTACT SURFACE IN REAL SHOCK-TUBE FLOW
Hans J. Gerhardt Mar. 1971 51 p refs Prepared in cooperation with Brown Univ.
(Contract N00014-67-A-0226; Proj. Squid)
(AD-722691; SQUID-TR-BRN-21-PU) Avail: NTIS CSCL 20/4

The deviation of shock velocity and contact surface velocity from the ideal velocities in low pressure shock tubes has been investigated analytically. Viscous effects and heat conduction to the shock tube walls have been taken into account. Momentum and continuity equations have been applied to a control volume fixed with respect to the contact surface. By using Mirels solutions for the boundary layer thickness, the algebraic system can be solved for the unknown shock velocity and contact surface velocity by interation. In this interative process the gas properties and boundary layer properties in the n-th iteration are assumed to depend on the shock velocity and contact surfaces velocity of the (n-1)-th iteration. Flow nonuniformities and real gas effects have been taken into account in the form of a correction factor derived from Connor and Anderson. The change of shock velocity as well as the change of contact surface velocity have been considered, thus giving the trajectories of shock wave and contact surface as functions of initial conditions, shock tube geometry and gas properties. It has been found that both the shock wave and the contact surface decelerate. This result agrees with previous experimental investigations by Anderson and Kelly. Author (GRA)

N71-32192*# Cornell Univ., Ithaca, N.Y.
NUMERICAL STUDY OF AXISYMMETRIC VORTEX BREAKDOWNS
K. E. Torrance and R. M. Kopecky Washington NASA Aug. 1971 42 p refs
(Grant NGL-33-010-064)
(NASA-CR-1865) Avail: NTIS CSCL 20D

Axisymmetric flow of a rotating stream is analyzed to determine conditions which will allow an isolated eddy (vortex breakdown) to develop. The eddy represents a fluid region totally confined by the external stream. The effects of axial velocity, swirl distribution, and viscosity on eddy formation are systematically explored with the aid of numerical solutions of the governing dynamic equations. These solutions also provide the structure of the flow inside and outside of the eddy. The structure is displayed with figures illustrating streamline contours for two inlet geometries. Ranges of axial flow Reynolds number and swirl ratio are determined which lead to confined eddies. Author

N71-32210*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
METHOD FOR PREDICTING COMPRESSIBLE TURBULENT BOUNDARY LAYERS IN ADVERSE PRESSURE GRADIENTS
S. Z. Pinckney Washington Aug. 1971 59 p refs
(NASA-TM-X-2302; L-6802) Avail: NTIS CSCL 20D

In connection with research programs on hypersonic airbreathing propulsion, an integral method for predicting boundary layer development in transition and turbulent flow regions on two-dimensional or axisymmetric bodies has been developed through use of the integral-momentum, moment-of-momentum, and energy equations together with appropriate auxiliary equations. The method has the capability of predicting nonequilibrium velocity distributions. It employs some simplifying assumptions, such as flat-plate friction and heat-transfer coefficients, no provision for a normal pressure gradient, and perfect gas relations; therefore, the method is considered interim in nature. Extensive comparisons have been made with data covering a wide Mach number range, cooled and uncooled walls, two dimensional and axisymmetric bodies with and without regions of longitudinal-pressure gradients, and a few cases with strong normal-pressure gradients. The overall conclusion is that the method will predict the displacement, momentum, and boundary-layer thickness of the data within the limits of the experimental accuracy. Author

N71-32227# Sandia Corp., Livermore, Calif.
SUMMARY OF SOME CALIBRATION AND MEASUREMENT PROCEDURES USED FOR PARTIAL PRESSURE ANALYSIS
L. C. Beavis Oct. 1970 34 p refs

(Contract AT(29-1)-789)
(SCL-DR-70-275) Avail: NTIS

Techniques used for measuring leaks and gas mixtures with a partial pressure analyzer are described. Examples and sample calculations for four methods are presented. Author

N71-32245*# Illinois Univ., Chicago. Dept. of Energy Engineering.
A TURBULENCE DESCRIPTION OF COUETTE FLOW
Paul M. Chung Jun. 1971 45 p refs
(Grant NGR-14-012-012)
(NASA-CR-119687; TR-E-39) Avail: NTIS CSCL 20D

The simplified statistical theory developed earlier is made self-containing for the wall shear flows. During the course of the formulation, the comparison of the present theory, developed from the generalized Brownian motion, with the stochastic theory based on the Navier–Stokes equation, was made. The mutual consistency of the two theories was shown. Analysis of the resulting equations shows that the flow field naturally divides itself into the three layers of the outer, transition, and the inner layers. The contribution of the small eddies through viscosity to all observable properties is negligible in the outer layer, whereas its contribution to the mean shear is of first order in the transition layer. In the inner layer, all viscosity effects are of first order. The comparison of the Couette flow solutions obtained with the available experimental results shows that the present theory describes the rather detailed turbulence structure of the flow field satisfactorily in addition to correctly predicting the mean velocity profile and the surface shear. Author

N71-32286 New York Univ., N.Y.
A NEARLY-NORMAL THEORY FOR DECAYING, ZERO-MEAN TURBULENCE
Gary Spencer Deem (Ph.D. Thesis) 1969 143 p
Avail: Univ. Microfilms Order No. 70-16049

A theory, based upon a new relation between double and triple-velocity moments, is presented for the decay of three dimensional, incompressible, zero-mean turbulence. This relation is a first order consequence of the hypothesis that the random velocity field decompose into the sum of a multitime Gaussian and a first order, non Gaussian random process. The latter is also assumed to be statistically odd with respect to the former. These hypotheses generalize certain properties of rapidly convergent ordinary Wiener–Hermite expansions of the random velocity field. The results of numerical integrations, based on the present theory with initially homogeneous and isotropic, Gaussian statistics, are presented for moderate Reynolds numbers R sub lambda < or = to 100. The solutions show good agreement with those obtained from the Kraichman direct interaction theory and are reasonably consistent with laboratory experiments, provided the analytic initial spectra are sufficiently realistic. Dissert. Abstr.

N71-32264# Boeing Scientific Research Labs., Seattle Wash. Flight Sciences Lab.
THE TWO DIMENSIONAL SEPARATED FLOW REGION UPSTREAM OF INERT AND CHEMICALLY REACTIVE TRANSVERSE JETS
William J. Thayer, III (Ph.D. Thesis–Wash. Univ.) Mar. 1971 170 p refs
(D1-82-1066) Avail: NTIS

The separated flow region upstream of a two dimensional jet was investigated experimentally. Highly underexpanded hydrogen, helium, and nitrogen jets were injected from converging slot nozzles perpendicular to a uniform Mach 2.5 air stream above a flat plate. The resulting upstream recirculation region was investigated with and without chemical heat release. A well mixed flow model was used to describe this region. Wall pressure, temperature, gas sampling, and optical measurements were made through a wide range of jet and air stream temperatures and pressures, including those at which hydeogen ignited spontaneously. This information and the well mixed recirculation region model were used to determine the dependence of gas dynamic, transport, and chemical flow field properties on the controlling parameters. Gas dynamic flow field properties were found to correlate with the jet to free stream pressure ratio, the Reynolds number, based on the distance from the leading edge to the separation point, and the jet and free stream densities. Supersonic combustion experiments were also conducted. Author

N71-32276*# Massachusetts Inst. of Tech., Cambridge. Space Propulsion Lab.
A REVIEW OF CONFINED VORTEX FLOWS
W. S. Lewellen Washington NASA Jul. 1971 225 p refs
(Contract NSR-22-009-288)
(NASA-CR-1772) Avail: NTIS CSCL 20D

Various possible exact and approximate solutions of the axisymmetric Navier–Stokes Equations related to confined vortex flows are derived and discussed. Comparisons with available experimental data are made. The influence of compressibility on both potential and laminar viscous flow is discussed. Theory and experiments relating to transition to turbulence is reviewed and some new empirical correlations for turbulent vortices are given. Application of the vortex tube as a fluidic device; as a cyclone separator and as an energy separator are considered in some detail with simple design formulae given. An assessment of the various modes of using a vortex for fluid dynamic containment for a gaseous core nuclear reactor is made, with the problems which remain to be solved delineated. A bibliography is included. Author

N71-32315 Maryland Univ., College Park.
THE STRUCTURE OF HYDROMAGNETIC SHOCKS IN REGIONS OF VERY LOW IONIZATION
Dermott Joseph Mullan (Ph.D. Thesis) 1969 173 p
Avail: Univ. Microfilms Order No. 70-16026

Detailed models for several gas flow shocks were computed to determine the heating and drifting of ions relative to the atoms resulting from momentum transfer. The hydromagnetic approximation was used to derive the equations describing the spatial variations of temperature and velocity of ions and atoms in the rest frame of the shock. It was found that the ions temporarily become several hundred degrees hotter than the atoms in a shock which heats the gas from 100 K to 1000 K. Ions which are much heavier than the atoms are heated by a greater amount than ions of the same mass as the atoms. Relative velocities of ions and atoms up to 3 km/sec occur in these shocks. It was concluded that the magnetic field is compressed more efficiently by ion-atom drift than by high ion temperatures. The ion temperatures do not remain high for a sufficiently long time to give observable effects. The results are of interest in star formation and also of interest in the reconnection of field lines in interstellar space and in the solar chromosphere. Dissert. Abstr.

N71-32328# Lehigh Univ., Bethlehem, Pa. Dept. of Mechanical Engineering and Mechanics
SWITCHING DYNAMICS OF BISTABLE FLUID AMPLIFIERS
Mustafa R. Ozgu and Alan H. Stenning Mar. 1971 232 p refs
(Contract N00014-69-A-0417)
(AD-723832; TR-3) Avail: NTIS CSCL 13/7

The report describes an experimental investigation of the transient switching of bistable amplifiers with low setbacks and variable configuration. The experimental observations were used to establish the mechanism of the switching action which was then used to guide the development of a theoretical model for the first two phases of the contacting-both-walls type of switching. The theory is based on the flow model for a two-dimensional jet attaching to an adjacent side-wall. The amplifier was of conventional design with straight and curved side-walls, cusped and pointed

splitters and variable control port width. The power jet width was 3/4 in. and two aspect ratios, 3 and 1, were tested. Water was used as the fluid and the element was operated at three different Reynolds numbers based on the power nozzle width - 8000, 5000 and 2000. The control flow was always a step or pulse and it was varied from a maximum, i. e., Q sub c = Q sub o, to a minimum beyond which no switching could be initiated. Effects of loading, inertia of the fluid in the output legs and residual flows from the inactive control port were determined. Load changes were simulated by reducing the exit area of the output legs using a flat plate orifice. The flow field was made visible by generating hydrogen bubbles in the power nozzle and at the power nozzle exit.
Author (GRA)

N71-32332# Rutgers Univ., New Brunswick, N.J. Dept. of Mechanical Aerospace Engineering.
PHYSICAL AND NUMERICAL EXPERIMENTS ON TIME-DEPENDENT ROTATIONAL COUETTE FLOW
David C. S. Liu and C. F. Chen Feb. 1971 149 p refs
(Grants NSF GK-14275; NSF GK-2096)
(PB-198559; RU-TR-136-MAE-F) Avail: NTIS CSCL 20D

The viscous, time-dependent rotational Couette flow was investigated by using bbb physical and numerical experiments. Physical experiments were carried out in an annular region formed by two concentric cylinders. The fluids were distilled water and a distilled water-glycerine mixture. A dye injection technique was used to make the motion of the fluid visible. Two modes of rotation of the inner cylinder were investigated. In the numerical experiments, explicit finite-difference approximations were used to solve the nonlinear partial differential equations. Calculations were made for an infinite geometry and the results were compared with experimental data.
Author (GRA)

N71-32350 Iowa Univ., Iowa City.
A FREE-STREAMLINE MODEL OF A TWO-DIMENSIONAL WAKE
Clark Anching Lin (Ph.D. Thesis) 1970 69 p
Avail: Univ. Microfilms Order No. 70-15618

Flow of a uniform stream past a two-dimensional wedge (or flat plate) with finite separation pocket is simulated by a pair of symmetric closed free streamlines placed behind a wedge (or a flat plate). Explicit solutions of the problem are obtained by conformal mapping. The physical plane was treated as triply connected and mapped to a canonical annular region and then to a parametric rectangular region. Analytic continuations are possible, by the Schwarz reflection principle, to permit the construction of mapping functions in terms of the Weierstrass elliptic and associated functions. The corresponding flows with symmetric wall restrictions were also solved. Some cases of flow past a flat plate with and without walls were computed.
Dissert. Abstr.

N71-32362 Iowa Univ., Iowa City.
VORTEX SWITCHING OF PLANAR JETS
Frank Richard Swenson (Ph.D. Thesis) 1970 102 p
Avail: Univ. Microfilms Order No. 70-15648

The results of a study of the forced switching and induced switching of planar jets by vortex flows are presented. The vortex flow is generated in a vortex diode with the diode axis normal to the plane of the two-dimensional jet. The cases of forced switching and induced switching are discussed and typical data are presented for each case.
Dissert. Abstr.

N71-32378 Cornell Univ., Ithaca, N.Y.
INCOMPRESSIBLE LAMINAR BOUNDARY LAYER FLOW INSIDE AND OUTSIDE OF A LIQUID SPHEROID MOVING THROUGH A LIQUID
Brice Saunders Sumner (Ph.D. Thesis) 1970 138 p
Avail: Univ. Microfilms Order No. 70-17103

A small time, impulsive start problem was solved for the liquid sphere to gain information about the nature of the inside flow. This solution confirms the detached feature of the wake eddy at early times and also suggests that the inside flow does not separate. A photographic experiment was used to demonstrate that the inside flow does not separate even though the outside flow does. Using the small Reynolds number and small time theories and the experimental results, a model for the flow when there is separation of the outside boundary layer is suggested. In this model the outside separation ring is above the sphere surface. Part of the outside boundary layer separates and goes downstream around the wake eddy, and the remaining outside layer stays attached, continuing between the drop and the wake eddy to the rear stagnation point. The inside boundary layer stays attached all the way to the rear stagnation point from which it exits as a forward moving wake.
Dissert. Abstr.

N71-32416*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SIMILAR SOLUTIONS FOR TURBULENT BOUNDARY LAYER WITH LARGE FAVORABLE PRESSURE GRADIENTS (NOZZLE FLOW WITH HEAT TRANSFER)
James F. Schmidt, Donald R. Boldman, and Carroll Todd Washington Aug. 1971 63 p refs
(NASA-TN-D-6439; E-6109) Avail: NTIS CSCL 20D

In order to provide a relatively simple heat-transfer prediction along a nozzle, a differential (similar-solution) analysis for the turbulent boundary layer is developed. This analysis along with a new correlation for the turbulent Prandtl number gives good agreement between the predicted and the measured heat transfer in the throat and supersonic region of the nozzle. Also, the boundary-layer variables (heat transfer, etc.) can be calculated at any arbitrary location in the throat or supersonic region of the nozzle in less than a half minute of computing time.
Author

N71-32462# California Univ., Berkeley. Hydraulic Engineering Lab.
MIXING OF MERGING BUOYANT JETS FROM A MANIFOLD IN STAGNANT RECEIVING WATER OF UNIFORM DENSITY
Paul Liseth (Ph.D. Thesis) Nov. 1970 196 p refs
(PB-198405; HEL-23-1) Avail: NTIS CSCL 20D

Submerged manifolds which are commonly used for waste water disposal into estuaries and the ocean are discussed. The mixing of buoyant jets from a long manifold discharging into stagnant receiving water of uniform density was studied by means of hydraulic model experiments. The manifold consisted of a pipe with round ports along both sides, issuing jets horizontally. The mixing of merging jets from a manifold was studied to provide the basis for a manifold design with respect to port spacing, port size, and jet discharge velocity.
Author (GRA)

N71-32472# Lehigh Univ., Bethlehem, Pa. Center for the Application of Mathematics.
EXACT EXPRESSIONS FOR CURVED CHARACTERISTICS BEHIND STRONG BLAST WAVES
O. Laporte (Mich. Univ., Ann Arbor) and T. S. Chang (North Carolina State Univ.) Jan. 1971 27 p refs
(Contract DAAD05-69-C-0053; Proj. Themis)
(AD-722777; CAM-110-14; BRL-30) Avail: NTIS CSCL 20/4

Exact solutions, expressed in closed forms in terms of elementary functions, are presented for the three sets of curved characteristics behind a self-similar, strong blast wave.
Author (GRA)

N71-32518 Pennsylvania Univ., Philadelphia.
A TECHNIQUE FOR STUDYING MICROMIXING RATES IN LIQUID SYSTEMS

Milton Michael Somers, Jr. (Ph.D. Thesis) 1969 242 p
Avail: Univ. Microfilms Order No. 70-16215

A new method was developed to measure the time to mix a feed stream introduced into a continuous flow tank reactor with adjacent reactor fluid on a molecular scale. The method used the conversion of an organic material (acetal) as a tracer for the mixing of an acidic feed stream with adjacent basic reactor fluid. Two mixing models were developed from which, with a knowledge of the hydrolysis reaction kinetics, a segregation time could be estimated. The concept of a single "packet" size of segregated portions of the feed stream was used, and these sizes were estimated with one of the mixing models. The results of this study can be applied to other systems if the vessel geometry and the hydrodynamic conditions are the same as those of this study. Dissert. Abstr.

N71-32529# Massachusetts Inst. of Tech., Cambridge. Fluid Mechanics Lab.
AN EXPERIMENTAL STUDY OF PERISTALTIC PUMPING
Stephen L. Weinberg, Eugene C. Eckstein, and Ascher H. Shapiro Mar. 1971 51 p refs
(Contract N00014-67-A-0204-0008)
(AD-723870; PUB-71-6) Avail: NTIS CSCL 20/4

In an experimental apparatus that approximated a two-dimensional, infinite train of peristaltic waves, measurements were made of mean flow, of mean pressure rise, and of pressure-time pulses at fixed locations. In addition, visual observations of reflux and trapping were made using dyed fluid. A theory was confirmed with respect to mean pressure vs. mean flow, pressure vs. time, reflux, and trapping. Controversy regarding the criterion of material reflux was settled in favor of the Lagrangian time-mean velocity rather than the Eulerian time-mean velocity. Author (GRA)

N71-32540# RAND Corp., Santa Monica, Calif.
CALCULATION OF GAS EXPANSION IN A RAREFIED ATMOSPHERE
Harold L. Brode and James E. Enstrom Mar. 1971 30 p refs
(P-4562) Avail: NTIS

Recent published similarity solutions for spherically and cylindrically symmetric gas expansions in rarefied atmospheres are extended to include the influence of ambient pressure. The former solutions and the extended solutions are then compared with exact numerical calculations for the same gas expansions. Limits of applicability of each solution are discussed and results compared with observations for typical barium gas release in the upper atmosphere. The extended similarity solutions have a range of validity up to an order of magnitude greater than that of the previous solutions. However, all of the similarity solutions are rendered inapplicable by the early onset of diffusion as the dominate expansion mechanism. Apparent agreement at later times is due to the similar growth rates for diffusion and similarity. Author

N71-32561*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
PARTICLE DISLODGEMENT AND ENTRAINMENT BY A LOW DENSITY AIRSTREAM FLOWING OVER A SURFACE
R. K. Weinberger and G. L. Adlon Washington NASA 6 Aug. 1971 81 p
(Contract NAS1-8137)
(NASA-CR-111924) Avail: NTIS CSCL 20D

An experimental technique was developed and a preliminary investigation made of the dislodgement and subsequent entrainment of solid particles by a stream of low density air flowing over a particulate surface. Four size ranges of solid particles and two surface profiles were tested. At the inception of surface erosion the following were determined: airstream dynamic pressure, airstream density, aerodynamic shear stress on the surface and/or surface resistivity, particle departure angle, and particle departure velocity. In addition, the entrained particles were trapped at several heights above the surface and the size distributions determined. The data indicate that the dynamic pressure of the airstream required to dislodge particles increases with the average particle size. There was, however, no systematic trend showing a change in threshold airstream conditions with a very large change in surface roughness. Particles were observed to leave the surface with a very large range of velocity vectors. Particle spin was also observed. The saltation layer particle size distribution had no apparent systematic change with height above the surface. Author

N71-32563*# General Electric Co., Schenectady, N.Y. Research and Development Center.
THE CALCULATION OF OPTIMAL LININGS FOR JET ENGINE INLET DUCTS, PART 2
J. P. D. Wilkinson Washington NASA Aug. 1971 31 p refs
(Contract NASw-1922)
(NASA-CR-1832) Avail: NTIS CSCL 20D

A numerical method is presented for calculating the optimal lining impedance for the inlet duct of a jet engine. The calculation is based on the condition that the total radiated power from the duct shall be a minimum. Several situations are considered: first, the case of an axially symmetric duct in a stationary acoustic medium; second, that of a body of arbitrary geometry in a stationary medium; and finally, the case of an axially symmetric duct in the presence of spinning modes and axial air flow. In each case, the method may yield the optimal lining impedances for a given discrete frequency, flow velocity, and duct geometry. To demonstrate the application of the method, a number of cases are investigated. First, a cylindrical duct closed at one end with a vibrating piston is used to make comparisons with predictions obtained analytically by Rice. Then a more complex problem of a bell-mouth compressor is investigated. A discussion of the results obtained is presented, together with a critique of the potential difficulties of the method as applied to complex duct configurations. Author

N71-32606# Rand Corp., Santa Monica, Calif.
A CRITIQUE OF THE SHARP SHOCK PROCEDURE
R. A. Papetti and R. L. Bjork (System Sci. and Software, San Diego) Jan. 1971 25 p refs
(P-4556) Avail: NTIS

A modification of a Particle-In-Cell (PIC) hydrodynamic code is discussed. The usual forms of PIC codes, represent shocks by a rapid but smooth variation of the independent variables over a span of approximately three spatial grid increments. The modification represents shocks by discontinuities whose jump conditions and propagation velocities roughly satisfy the Hugoniot relations. Author

N71-32608 Minnesota Univ., Minneapolis.
STRUCTURE OF A STRONG SHOCK IN A MONATOMIC GAS
Peter Daniel Lohn (Ph.D. Thesis) 1969 91 p
Avail: Univ. Microfilms Order No. 70-15786

The structure of a strong shock in a monatomic gas is investigated. Restricting consideration to infinite Mach number, a bi-modal form for the molecular velocity distribution function is proposed. When considering rigid sphere molecules, the assumed bi-modal form allows the Boltzmann equation to be split into two coupled equations describing the behavior of the two assumed modes. The solution of these equations is then approximated. The logical first approximation to this solution turns out to be the Mott-Smith (Sakurai) solution. This solution is known to be the best Mott-Smith type solution in the sense of minimization of the error in solving the Boltzmann equation. Further approximations may be regarded as attempts at improving this Mott-Smith (Sakurai) solution. Approximations are obtained by satisfaction of an appropriate number of moment equations. Dissert. Abstr.

N71-32618 Maryland Univ., College Park.
INVESTIGATION INTO THE BREAKUP OF LIQUID SHEETS AND JETS IN A SUPERSONIC GAS STREAM
Allan Sherman (Ph.D. Thesis) 1969 115 p
Avail: Univ. Microfilms Order No. 70-16033

An experimental and theoretical investigation into the breakup of liquid sheets and jets in a supersonic gas stream is presented. Liquid sheets were experimentally studied by microphotographs and high speed movies of the activity of a liquid layer maintained upon the surface of a porous plate test model. The results show wave motion with droplet and ligament shedding across the liquid surface. The linearized analysis of the liquid sheet problem is expanded to approximate the effect of the gas shear at the liquid-gas interface. Numerical solutions of the equations show that the gas shear has little effect on the liquid surface stability or instability. Liquid jets were experimentally studied with spark shadow-graphs and high speed movies of the normal injection of four different liquids into nozzles of varying diameter. The results show that the breakup mechanism is characterized by gross jet fracture, with the subsequent disintegration of the resulting pieces of fluid. Theoretical models presented heretofore for the breakup of a liquid, when injected normally into a high velocity gas stream, do not accurately describe the actual physical processes. It is suggested that an analysis of the breakup mechanism must include the whole jet, with the force system which causes fracture. Furthermore, the analysis must include criteria by which the fractured pieces of the jet disintegrate into droplets. Dissert. Abstr.

N71-32623# National Aeronautical Establishment, Ottawa (Ontario).
SOME PRELIMINARY ASSESSMENTS OF COMPRESSIBLE TURBULENT BOUNDARY LAYER STUDIES AT MACH 4 AND AT HIGH REYNOLDS NUMBERS, INCLUDING FLOWS IN RELAXING AND ADVERSE PRESSURE GRADIENTS
David J. Peake, Julian M. Romeskie (McGill Univ., Montreal), and Georg Brakmann (McGill Univ., Montreal) *In* Natl. Res. Council of Can. Div. of Mech. Eng. and the Natl. Aeron. Estab. Mar. 1971 p 27–99 refs (See N71-32620 19-34)
Avail: NTIS

The influence of streamwise pressure gradients upon two dimensional compressible turbulent boundary layers at high Reynolds numbers is considered. Boundary layers recovering to equilibrium conditions are of special interest. Measurements are made at Mach number 4 of pressure distribution, local skin friction and boundary layer profiles along the internal surface of a parallel, circular cross section duct. Results from three experiments namely a near zero pressure gradient flow, an adverse pressure gradient case, and a flow relaxing downstream of a step-induced separation are compared against the respective calculation methods of Bradshaw, Chan, and Green, in terms of integral parameters, local skin friction coefficients, and velocity profiles. Author

N71-32628# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Reaktorbauelemente.
THEORETICAL METHOD FOR CALCULATION OF TWO PHASE FLOW WITH CHANGE OF PHASE IN A FLASH EVAPORATION [EIN THEORETISCHES VERFAHREN ZUR BERECHNUNG DER ZWEIPHASENSTROEMUNG MIT PHASENWECHSEL IN EINEM EINSPRITZVERDAMPFER]
I. Gaballah Nov. 1970 30 p refs In GERMAN; ENGLISH summary
(KFK-1300) Avail: AEC Depository Libraries

A theory was developed for calculation of two phase flow with change of phase. The basic equations were formulated and solved numerically. The results show that the steam temperature and the steam wetness at the inlet of the evaporator channel decrease very rapidly, but decrease only to a very small extent at low wetness of the steam and low degree of superheating. Also, the strong increase in the length required for evaporation with a low prescribed wetness and low prescribed degree of superheating at the end of the evaporator channel was shown. Author (NSA)

N71-32641 National Lending Library for Science and Technology, Boston Spa (England).
FLOW SHAPE, STEAM VOLUME FRACTION AND PRESSURE DROP IN TWO PHASE FLOW OF WATER STEAM IN TUBES
A. Kutukouogu 25 Aug. 1970 92 p Transl. into ENGLISH from Report EIR-145
(NLL-RISELEY-Trans-1930-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.

The attenuation of a collimated gamma beam as it passes through a tubular test section, through which flows a two phase mixture of water and steam was used to determine the local distribution of liquid, and the average steam volume fraction. The total pressure drop was measured and hence the friction losses were determined. To develop and test the measuring instrumentation a low pressure evaporation circuit was used on which 21 series of measurements were performed. The parameters measured were: pressure; mass flow density; mass flow ratio of steam; and horizontal, unheated test section. From a comparison of the actual measuring range with different methods of calculating the flow forms, it was shown that with the exception of a few measuring points with lower mass flow densities and mass flow ratio of the steam, the flow was mainly annular. Author

N71-32670 Minnesota Univ., Minneapolis.
TURBULENT HEAT TRANSFER IN TUBES HAVING TWO-DIMENSIONAL ROUGHNESS, INCLUDING THE EFFECT OF PRANDTL NUMBER
Ralph Lee Webb (Ph.D. Thesis) 1969 210 p
Avail: Univ. Microfilms Order No. 70-15833

The heat transfer and friction characteristics for turbulent flow in tubes having uniformly spaced thin ribs oriented transverse to the flow was investigated. The roughness was described by its dimensionless height e/D, where D is the tube diameter, and the dimensionless rib spacing p/e. Five rough tubes were constructed. Each test section consisted of two identical copper tubes 5 feet long with an inside diameter of 1.45 inches. The first tube served as an unheated hydraulic entrance section, and electrical heat was generated in a Nichrome ribbon wrapped on the second (downstream) tube. The apparatus was designed for use of gases or liquids as the heat transfer medium. The Prandtl number range was covered with three fluids; air (Pr = .71), water (Pr = 5.1), and n-Butyl alcohol (Pr = 21.7 and 37.6). The friction factor correlation was based on the assumed existence of a logarithmic velocity distribution. The heat transfer data for all rough tubes were correlated with about + or − 7.0% maximum deviation using correlating parameters defined by a heat-momentum transfer analogy model. Dissert. Abstr.

N71-32683 Denver Univ., Colo.
VISCOELASTIC EFFECTS IN POLYMER FLOW THROUGH VARIOUS POROUS MEDIA
George L. Levy (Ph.D. Thesis) 1969 169 p
Avail: Univ. Microfilms Order No. 70-16541

Viscoelastic effects are found to exist in the flow of Carboxymethycellulose and Polyacrylamide solutions through unconsolidated porous media. These elastic responses are significantly affected by the geometry of the porous media. Flow into, through and out of a capillary tube is studied as a means for modeling the elastic response in porous flow. A capillary device, designed and constructed to measure the total pressure loss due to converging flow in the entrance of a tube is used to determine an elastic end correction pressure loss. The Weissberg equation modified to fit the data in this work adequately predicts the viscous portion of the

total end correction pressure loss. For flow situations in which fluids experience expansion and contraction such as in porous flow, the elastic pressure loss is thought to be a more realistic term than the primary normal stress value for the determination of a relaxation time. Dissert. Abstr.

N71-32688 National Lending Library for Science and Technology, Boston Spa (England).
PRESSURE DROP IN ROD BUNDLES WITH SPIRAL WIRE SPACERS
K. Rehme Jan. 1971 11 p refs Transl. into ENGLISH from Forsch. Ingenieurw. (West Germany), v. 35, no. 4, 1969 p 107–112
(NLL-RISLEY-Trans-2082-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

In the range of Reynolds numbers from 2 × 1,000 to 2 × 100,000 measurements have been made on 75 different rod bundles with spiral wire spacers. The rods, in hexagonal arrangement, were all wound in the same direction with single-start spiral wire, the diameter of which determined the spacing. By varying the number of rods in the bundle, the spacing ratios of the rods and the pitch of the spirals it was possible, after introducing a modified velocity, to determine the dimensionless form the dependence of the pressure drop on these quantities. The results show good agreement with the measured values given in the literature. Author

N71-32723 Minnesota Univ., Minneapolis.
CAPILLARY HYDRODYNAMICS: INTERFACIAL INSTABILITY AND THE SOLID/LIQUID/FLUID CONTACT LINE
Chun Huh (Ph.D. Thesis) 1969 312 p
Avail: Univ. Microfilms Order No. 70-15746

The theory of configurational stability of fluid menisci that make contact with solid surfaces is treated. Because meniscus intersects solid in a three-phase contact line, considerable attention is given to conditions that may be observed at the solid/liquid/fluid contact line. These are found to affect the appearance of instability of mechanical equilibrium in static solid/liquid/fluid systems, instability showing up as amplifying disturbances of the shape of the liquid/fluid interface. Physical evidence is brought forward showing that fluids very near the contact line are in a special state of matter and believe unusually both at rest and in motion. Two extreme idealizations are delineated: contact line remains fixed and contact angle changes as required; and contact line is free to move but contact angle remains at its initial value. These idealizations are used as alternative boundary conditions in stability analyses. Dissert. Abstr.

N71-32742# Lockheed Missiles and Space Co., Palo Alto, Calif.
INVESTIGATION OF THE PARAMETERS OF AXISYMMETRIC UNDEREXPANDED IDEAL GAS JETS
G. I. Averenkova et al [1970] 10 p refs Transl. into ENGLISH of the book "Vychislitel'nye Metody i Programmirovanie" no. 15, Moscow Univ. Press, 1970 p 92–101
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Results of computing supersonic flow in axisymmetric ideal gas jets, taking account of the central compression shock, are presented. E.H.W.

N71-32788*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INTERFACE STABILITY DURING LIQUID INFLOW TO PARTIALLY FULL, HEMISPHERICAL ENDED CYLINDERS DURING WEIGHTLESSNESS
Eugene P. Symons and John V. Staskus Washington Aug. 1971 27 p refs
(NASA-TM-X-2348; E-6346) Avail: NTIS CSCL 20D

The stability of the liquid-vapor interface during liquid inflow to a partially full hemispherical ended cylinder during weightlessness was studied. The investigation was limited to one tank radius (2 cm), one inlet line radius (0.2 cm), and three test liquids (ethanol, carbon tetrachloride, and trichlorotrifluoroethane). A stable region and an unstable region of interface behavior were noted. The velocity which delineated between the two regimes was termed the critical inflow velocity. Results indicate that the critical inflow velocity increases with increasing initial liquid depth and further indicate that this increase is more pronounced when the initial velocity profile of the incoming liquid jet is uniform rather than partially parabolic. Author

N71-32793*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPUTER PROGRAM FOR DESIGN OF TWO-DIMENSIONAL SHARP-EDGED-THROAT SUPERSONIC NOZZLE WITH BOUNDARY LAYER CORRECTION
Louis J. Goldman and Michael R. Vanco Washington Aug. 1971 61 p refs
(NASA-TM-X-2343; E-6261) Avail: NTIS CSCL 20D

A FORTRAN 4 computer program was presented for the design of sharp-edged-throat supersonic nozzles where losses were accounted for by correcting the ideal nozzle geometry for boundary-layer displacement thickness. The ideal nozzle was designed by the method of characteristics. Boundary layer parameters were calculated by Cohen and Reshotko's method for laminar flow and Sasman and Cresci's method for turbulent flow. Author

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N71-31627# Tri-State Transportation Commission, New York.
MANAGING THE NATURAL ENVIRONMENT: A REGIONAL PLAN FOR WATER, SEWAGE, AIR AND REFUSE
Richard S. De Turk Mar. 1970 21 p
(PB-190290) Avail: NTIS CSCL 13B

A tri-state regional plan is outlined for water, sewage, air, and refuse management. Methods of tapping natural resources to further these projects are suggested. It is estimated that the project will cost 9.7 billion dollars. E.M.C.

N71-31678# Teledyne Isotopes, Westwood, N.J.
INVESTIGATIONS ON TRAVELLING IONOSPHERIC DISTURBANCES (TID'S) BY THE CW DOPPLER PHASE PATH SOUNDING ARRAY
Ganti L. Rao Nov. 1970 44 p refs
(Contract F44620-69-C-0038; ARPA Order 1316)
(AD-723318; IWL-7556-219; AFOSR-71-1187TR) Avail: NTIS CSCL 4/1

Travelling ionospheric disturbances in the ionized regions of the earths atmosphere have been investigated using a CW doppler (phase-path) sounding array. A description of wave characteristics such as periods and wavelengths for medium scale TIDs is given. An apparent correlation between TIDs and occurrence of sporadic E was examined in the light of internal atmospheric gravity wave theory. The results of the present investigation were compared with those of earlier results. It can be concluded from this study that near the solstices, TIDs in both hemispheres travel in approximately the same direction, away from the pole. Near the

equinoxes, TIDs in the Northern Hemisphere travel approximately in the westward direction, while those in the Southern Hemisphere travel eastward. Author, (GRA)

N71-31680# Teledyne Isotopes, Westwood, N.J.
ATMOSPHERIC PROPAGATION STUDIES UP TO 30 SEPTEMBER 1970 Final Summary Report, 1 Oct. 1969–30 Sep. 1970
Herman A. Montes Nov. 1970 80 p refs
(Contract F44620-69-C-0038; ARPA Order 1316)
(AD-723319; IWL-7556-220; AFOSR-71-1207TR) Avail: NTIS CSCL 4/1

The phase-path (doppler) sounder array was expanded to operate at two sounding frequencies simultaneously. Particular emphasis was given to the study of ionospheric background motions having periods longer than 5 minutes or so. It was found that the power spectra of the phase-path variations show the effect of a varying Vaisala frequency with height, probably modified by the effects of viscosity. It has also pointed out the potential of the doppler technique to measure the parameters of the neutral gas structure at ionospheric altitudes. Cophase analysis of phase-path records following Saturn-Apollo launches indicate that rocket generated infrasound is trapped at ionospheric heights by a wave-guide mechanism. Ionospheric motions detected by the doppler array following a large earthquake are found to have a phase velocity equal to that of seismic Rayleigh waves of the same period and to arrive from the direction of the epicenter. A study of the spatial coherence of ionospheric motions indicates reflection point separations of the order of 60 km are sufficient for noise decorrelation up to periods of 30 min; and separations of 90 to 100 km for periods longer than 30 min. Preliminary analysis of microbarograph records following some of the French tests of 1970 show arrivals of long period gravity waves with phase velocities of the order of 550 m/sec. Author (GRA)

N71-31681# Army Foreign Science and Technology Center, Charlottesville, Va.
RESULTS OF FIELD USE OF THE KVARTS PULSED-LIGHT RANGE FINDER [REZULTATY PROIIZVODSTVENNOGO PRIMENENIYA SVETODALNOMERA KVARTS]
Yu. A. Davydenko et al 18 Mar. 1971 7 p Transl. into ENGLISH from Geod. I Kartografiya (USSR), no. 12, 1969 p 9–10
(AD-723427; FSTC-HT-23-162-71) Avail: NTIS CSCL 8/5

During 1968 a Kvarts pulsed-light range finder was used in field work in the Arctic Circle. This instrument, which is now in standard production, evidently will replace similar range finders which have been used in the past. An indication of the great efficiency of this instrument is that during the 1967 field season the instrument made it possible to measure 14 sides, whereas in the preceding year only 12 sides could be measured with 3 EOD-1 range finders. GRA

N71-31690# Cologne Univ. (West Germany). Inst. fuer Geophysik und Meteorologie.
HAZE AND ITS INFLUENCE ON SCATTERED LIGHT DISTRIBUTION IN THE STRATOSPHERE [UEBER DIE EXISTENZ VON DUNST UND SEIN EINFLUSS AUF DIE STREULICHTVERTEILUNG IN DER STRATOSPHAERE]
J. Frank Nov. 1970 61 p refs In GERMAN *Its* Mitt. No. 16
Avail: NTIS

A qualitative investigation of stratospheric dust is made by comparing indirect ozone-radiosonde measurements and earth-based light intensity measurements. The boundaries of the dust belt are determined over Cologne and Tromso. ESRO

N71-31691# Kiruna Geophysical Observatory (Sweden).
PRELIMINARY RESULTS OF MAGNETOTELLURIC SOUNDING IN THE RANGE 0.01–10,000 Hz
Svante Westerlund Dec. 1970 27 p refs
(KGO-706) Avail: NTIS

Results of magnetotelluric measurements in the frequency range from 0.01 to 10,000 Hz are presented. Instrumentation and data reduction technique is also discussed. The results are encouraging although not satisfactory and some measures that could be adopted in order to improve the results are suggested. Author (ESRO)

N71-31692# Kiruna Geophysical Observatory (Sweden).
A FORTRAN PROGRAM PACKAGE FOR FREQUENCY ANALYSIS OF MAGNETOTELLURIC DATA
Svante Westerlund Dec. 1970 194 p
(KGO-705) Avail: NTIS

This report contains listings and other information about a package of computer programs that have been used for digital frequency analysis of magnetotelluric signals. Each program performs usually only one operation. The programs are stored on disk and are called in for execution in the sequence that they are needed. This mode of operation provides a very flexible system. Some of the tasks carried out by the system are: sampling of analog signals, calculation of correlation coefficients, spectra, and probability density distribution, digital filtering of data, plotting and printing of data and results. The report is written in the form of a Users Manual. Author (ESRO)

N71-31703# Groupe de Recherches Ionospheriques, Paris (France).
DESCRIPTION OF APPARATUS USED AT FORT-ARCHAMBAULT FOR MEASUREMENT OF IONOSPHERIC WINDS AND METHODS OF DATA PROCESSING [DESCRIPTION DE L'APPAREILLAGE UTILISE A FORT-ARCHAMBAULT POUR LA MESURE DES VENTS IONOSPHERIQUES ET VETHODES D'INTERPRETATION DES MEAASURES]
G. Doyen, M. Agogue, R. Lacroix, and J. Tabbagh May 1971 21 p refs In FRENCH; ENGLISH summary
A(GRI/NTP/86) Avail: NTIS

The principle used in the measurement of ionospheric drifts by Haubert's method is briefly recalled. The device described is automatic and fully transistorized. Two networks are used, each being mace of nine sensors. The equipment allows measurements on several frequencies and phase determinations. The geophysical data are recorded on film and on magnetic tape. The methods of processing film and tape data are finally called up. Author (ESRO)

N71-31726# California Univ., San Diego. Inst. of Geophysics and Planetary Physics.
EARTH STRAIN STUDIES Final Report, 1 Nov. 1968–30 Jun. 1970
Richard A. Haubrich and William E. Farrell 1 Apr. 1971 11 p refs
(Contract N00014-69-A-0200-6019)
(AD-723869) Avail: NTIS CSCL 8/3

Ground motion as elastic deformation due to loading by ocean tides, low frequency ocean waves and atmospheric pressure variations has been examined both theoretically and observationally. The observations have been made using vertical accelerometers at frequencies from a cycle a day to 140 cycles per hour. Author (GRA)

N71-31790# Deutscher Wetterdienst, Offenbach am Main (West Germany).
AIRBORNE SURFACE TEMPERATURE MEASUREMENTS OF THE SEA [FLUGZEUGMESSUNGEN DER OBERFLAECHENTEMPERATUR UEBER SEE]
Dieter Lorenz Bonn Bundeswehramt Sep. 1970 41 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Vertfidigung
(BMVg-FBWT-71-7) Avail: NTIS; Bundeswehramt, Bonn: 25 DM

Three series of airborne surface temperature measurements over the North Sea, mainly in the Bay of Helgoland, using infrared radiation thermometers are described. The resulting isotherm maps are discussed. Local changes and discontinuities of the water surface temperature are accounted for. In one case a change of 1.5 C was recorded within a short distance on deep sea. ESRO

N71-31797# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SEISMIC SCALING OF EXPLOSIVE SOURCE FUNCTIONS USING TELESEISMIC P WAVES
Clint W. Frasier 14 Apr. 1971 42 p refs
(Contract F19628-70-C-0230; ARPA Order 512)
(AD-723638; TN-1971-11; ESD-TR-71-116) Avail: NTIS CSCL 17/10

Short period P waves of four presumed Soviet explosions from Eastern Kazakh are examined at five teleseismic arrays: LASA, YKA, OONW, WRA and GBA. Transfer functions to shape the lower magnitude to the highest magnitude event were computed at each array to eliminate transmission path effects from source to receiver. The transfer functions are locally consistent from sensor to sensor at each array, but show considerable global variations from array to array. This suggests that there are strong azimuthal variations in the source radiation of the events, due to complex scattering of the signals at the test site. At LASA, the observed transfer functions can be explained by using explosion source functions of Blake and Haskell. The assumed source parameters are scaled functions of the yield of each event, which is estimated from an empirical amplitude yield relationship. Author (GRA)

N71-31808# Purdue Univ., Lafayette, Ind. School of Civil Engineering.
STRAIN DISTRIBUTION AROUND UNDERGROUND OPENINGS. TECHNICAL REPORT NO. 5: COMPARISON BETWEEN PREDICTED AND MEASURED DISPLACEMENTS Summary Report, 8 Sep. 1967 - 1 Jan. 1971
William R. Judd and William H. Perloff Mar. 1971 121 p refs
(Contract DACA73-68-C-0002)
(AD-723532; TR-5) Avail: NTIS CSCL 8/7

The objective of this research was to establish whether existing theoretical methods could be used to predict the amount of displacement that would occur around an underground opening during or soon after the excavation process. The first step of the study selected a finite element method of analysis based upon an elastic continuum as the most promising theoretical method. The accuracy of the predictions was analyzed by comparison with in-situ measurements of strain around as-built openings. For three of the five openings analyzed, three appeared to present no useful correlation between the magnitudes of the predicted and measured displacements; for two of the openings (Morrow Point and Green River), 75% of the cases where the displacements were in the same direction had less than an order of magnitude difference in the amount of the displacement. In general, a finite element method based upon an elastic continuum does not appear to provide an acceptable predictive method except where the rock-system behavior approximates that of an elastic continuum. Author (GRA)

N71-31810# Army Foreign Science and Technology Center, Charlottesville, Va.
ALPHABETICAL INDEX OF ARTICLES PUBLISHED IN 1969 IN THE JOURNAL "GEODESY AND CARTOGRAPHY" [LAFABITNYIOI UKAZATEL STATEOI OPUBLIKOVANNYKH I 1969 R. V. ZHURNALE "GEODEZIYA I KARTOGRAFIYA"]
18 Mar. 1971 21 p refs Transl. into ENGLISH from Geod. i. Kartografiya (USSR), no. 12, 1969 p 73-79
(AD-723428; FSTC-HT-23-165-71) Avail: NTIS CSCL 8/5

The list contains the titles and authors of all articles published in the Journal GEODESY AND CARTOGRAPHY during the calendar year 1969. Author (GRA)

N71-31817# Bureau of Public Roads, Washington, D.C. Office of Research and Development.
ELECTRONIC COMPUTER PROGRAM FOR ANALYTICAL STRIP TRIANGULATION (TIES COMPUTER PROGRAM NO. R-0200)
Jesse R. Chaves and George Strogis May 1970 40 p
(PB-198592) Avail: NTIS CSCL 08B

The computer program represents the combination of two previously published programs for analytical aerial triangulation. The first of these is titled Aerotriangulation: Image coordinate Refinement. The second is titled An Introduction to Analytical Strip Triangulation with a FORTRAN Program. Author (GRA)

N71-31818# Alaska Univ., College. Inst. of Water Resources.
A BIBLIOGRAPHY OF ARCTIC WATER RESOURCES
Charles W. Hartman and Robert F. Carlson Nov. 1970 543 p refs
(Contract DI-14-01-0001-3001)
(PB-198668; IWR-11) Avail: NTIS HC $8.00/MF $0.95 CSCL 08H

A bibliography of water resources in Arctic regions is presented. The entries were selected for inclusion on the basis of their relevance to understanding the nature of the land-based water cycle in Alaska's arctic and sub-arctic areas. References concerning glaciology, water supply, and waste disposal were included where available. GRA

N71-31828*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PROCEEDINGS OF THE GEOS-2 PROGRAM REVIEW MEETING. VOLUME 1: GRAVIMETRIC AND GEOMETRIC INVESTIGATIONS WITH GEOS-1 AND GEOS-2
Nov. 1970 378 p refs Meeting held at Greenbelt, Md., 22-24 Jun. 1970 Prepared in cooperation with Computer Sci. Corp., Falls Church, Va.
(NASA-TM-X-67271) Avail: NTIS HC $8.00/MF $0.95 CSCL 08N

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15. COMPARISONS OF INDEPENDENT INVESTIGATOR'S SURVEY ADJUSTMENTS ON THE NAD USING GEOS DATA J. H. Berbert and F. M. Loveless, Jr. (DBA Systems, Inc., Lanham, Md.) p 363–370 refs (See N71-31841 19-13)

16. ESTIMATES OF C BAND RADAR STATION POSITIONS AND INTERSITE DISTANCES C. D. Leitao and R. L. Brooks (Wolf Res. and Develop. Corp., Pocomoke, Md.) p 371–385 refs (See N71-31842 19-07)

N71-31827*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

GEODETIC SATELLITE DATA SERVICE REDUCED DATA RECEIVED AND PROCESSED AS OF 15 JUNE 1970

J. Johns *In its* Proc. of the GEOS-2 Program Rev. Meeting, Vol. 1 Nov. 1970 p 1–6 (See N71-31826 19-13)

Avail: NTIS HC$6.00/MF$0.95 CSCL 05B

Individual listings are presented for the Echo-1, GEOS-1, Pageos-1, GEOS-2, Explorer-22, Explorer-27, Diademe-1, and Diademe-2 satellites. Each listing contains the following: (1) name of the tracking network, (2) number of network observations, (3) number of satellite passes, and (4) time period covered. D.L.G.

N71-31828*# Smithsonian Astrophysical Observatory, Cambridge, Mass.

THE 1969 SMITHSONIAN STANDARD EARTH AND GLOBAL TECTONICS

E. M. Gaposchkin, W. M. Kaula, and K. Lambeck *In* NASA. Goddard Space Flight Center Proc. of the GEOS-2 Program Rev. Meeting, Vol. 1 Nov. 1970 p 7–60 refs (See N71-31826 19-07)

(Grants NGR-09-015-002; NSF GA-10963)

(SAO-009-49) Avail: NTIS HC$6.00/MF$0.95 CSCL 08E

Geodetic parameters describing the earth's gravity field and the positions of satellite tracking stations in a geocentric reference frame were computed. These parameters were estimated from a combination of four different types of data–routine and simultaneous satellite observations, observations of deep-space probes, and surface gravimetry. The global gravity field is represented by spherical harmonics complete to degree and order 16, plus a number of coefficients to which satellites are sensitive, a resolution of about 11 deg or 1200 km. The accuracy is established primarily by intercomparison. The coordinates of 12 fundamental stations are known to + or – 10 m or better, and those of 39 stations (or groups of collocated stations) are known to + or – 20 m or better. The accuracy of the global field is + or – 3 m in geoid height, or + or – 9 mgal. This solution leads to a new understanding of global tectonics and geodynamics. It shows ocean rises, as well as trench and island arcs, as mass excesses. Ocean basins, areas of recent glaciation, and the Asian portion of the Alpide belt are mass deficiencies. Most features appear to be the result of varying behavior of the lithosphere in response to asthenospheric flow. Author

N71-31829*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

TESTS AND COMPARISONS OF GRAVITY MODELS USING CAMERA OBSERVATIONS OF GEOS-1 AND GEOS-2

J. G. Marsh, B. C. Douglas (Wolf Res. and Develop. Corp., Riverdale, Md.) and M. L. Dutcher *In its* Proc. of the GEOS-2 Program Rev. Meeting, Vol. 1 Nov. 1970 p 61–88 refs (See N71-31826 19-13)

Avail: NTIS HC$6.00/MF$0.95 CSCL 08E

Optical observations of the GEOS satellites are used to obtain orbital solutions with different sets of geopotential coefficients. The solutions are compared before and after modification to high order terms (necessary because of resonance) and then are analyzed by comparing subsequent observations with predicted trajectories. The most important source of error in orbit determination and prediction for the GEOS satellites is the poorly modeled effect of resonance found in most published sets of geopotential coefficients. Modifications to the sets yield greatly improved orbits in most cases. The sets of coefficients analyzed are APL 3.5, NWL5E-6, Kohnlein (1967), Rapp (1967), Kaula (1967), Smithsonian Astrophysical Observatory (SAO)M-1 (1966), SAO COSPAR (1969), and SAO 1969. Author

N71-31830*# Computer Sciences Corp., Falls Church, Va.

COMPARISON OF THE SAO-1969 GRAVITY FIELD WITH SURFACE GRAVITY

William E. Strange *In* NASA. Goddard Space Flight Center Proc. of the GEOS-2 Program Rev. Meeting, Vol. 1 Nov. 1970 p 89–98 refs (See N71-31826 19-13)

Avail: NTIS HC$6.00/MF$0.95 CSCL 08E

A study was conducted to carry out a more critical comparison of the Smithsonian Astrophysical Observatory (SAO) 1969 gravity field representation and surface gravity than those previously reported in order to better establish the degree of accuracy of the SAO results. It has been generally felt that the accuracy with which the SAO 1969 solution represented average values of gravity over areas of dimensions of approximately 11 deg by 11 deg was about 8 to 10 mgals. However, results obtained in the present study indicate that this accuracy is more nearly in the range of + or – 4 to + or – 6 mgals. D.L.G.

N71-31831*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

DERIVATION AND TESTS OF THE GODDARD COMBINED GEOPOTENTIAL FIELD (GSFC 1.70-C)

James P. Murphy and James G. Marsh *In its* Proc. of the GEOS-2 Program Rev. Meeting, Vol. 1 Nov. 1970 p 99–118 refs (See N71-31826 19-13)

(X-522-70-104) Avail: NTIS HC$6.00/MF$0.95 CSCL 08E

A geopotential field complete to degree and order fifteen was derived by combining fifteen separate determinations of spherical harmonic coefficients. Among the fields combined were ones obtained from Doppler data, optical data, Doppler and optical data, optical and terrestrial data, optical, Doppler and terrestrial data, and small sets of coefficients obtained by methods of resonant satellite geodesy. Several tests of the combined gravity field were performed. The maximum difference between degree variances, obtained from this field and the corresponding ones obtained by Kaula in 1966 from free-air gravity anomalies is 4.5 m gal sq. The corresponding maximum difference obtained with the Smithsonian Astrophysical Observatory (SAO) 1966 Standard Earth was 9.9 m gal sq. After special resonant coefficients previously determined for the Geodetic Earth Orbiting Satellite (GEOS) I and II were substituted into the combined field, fits to six-day arcs of precisely reduced optical data were made. The rms of the fit to the GEOS I data arc was 2.3 sec which was the best fit among eight published fields considered. For GEOS II, the rms fit of 2.9 sec was second best among the eight fields. The SAO B13.1 (1969) model was used to obtain a fit of 2.3 sec for this GEOS II arc. For GEOS orbits 1 sec is approximately equal to 7 m. Some additional improvement to the fits were realized after the resonant coefficients (degree, order) = (13,12) and (13,13) were allowed to adjust. Author

N71-31832*# Naval Weapons Lab., Dahlgren, Va.

REDUCTION OF ERRORS IN COMPUTED SATELLITE ORBITS DUE TO UNCERTAINTIES IN GRAVITY COEFFICIENTS

R. J. Anderle *In* NASA. Goddard Space Flight Center Proc. of the GEOS-2 Program Rev. Meeting, Vol. 1 Nov. 1970 p 119–140 refs (See N71-31826 19-13)

Avail: NTIS HC$6.00/MF$0.95 CSCL 08E

The results are reviewed of observations of the GEOS-2 satellite, the last satellite launched specifically for geodetic applications. Discussions are given of the contribution the GEOS-2 has made to the computation of precise satellite orbits, the needs for additional satellite observations to continue this work, and the orbit conditions which would contribute best to further refinement of the gravity field. Author

N71-31833*# Aerospace Corp., El Segundo, Calif.

COMPARISON OF GEOPOTENTIAL MODELS FOR GEOS-1 EPHEMERIS PREDICTION

L. Wong and R. Prislin *In* NASA. Goddard Space Flight Center Proc. of the GEOS-2 Program Rev. Meeting, Vol. 1 Nov. 1970 p 141–186 refs Presented at 51st Ann. AGU Meeting, Washington, D.C., Apr. 1971 (See N71-31826 19-13)

(Contract NASw-1858)

Avail: NTIS HC$6.00/$0.95 CSCL 08E

A comparison of four geopotential models for the prediction of GEOS-I orbits over time spans of a month is described. The comparison is made on the basis of ephemerides calculated from Baker-Nunn-optical and Tranet-doppler observations over two 6-day arcs in 1966. The magnitude of the errors was found to be strongly dependent on the interaction between geopotential and radiation pressure constant, gamma. By assigning the proper value to gamma, each of the models could be used for predicting the ephemeris to within 2 km over a month period. The long-term in-track error consists of a secular component plus a nearly sinusoidal oscillation which has the same period as GEOS. The sinusoidal component is shown to be the differences of two Keplerian orbits having slightly different eccentricities. Tranet doppler orbits were consistent with optical orbits to within 40–60 meters. Hence, there was no necessity for combining the two sets of observations in a single solution. For a given geopotential model, the prediction errors from the two data types were approximately the same. Also, the sensitivities to geopotential changes were comparable even though the doppler set contains many more observations. Author

N71-31834*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

NASA STADAN, SPEOPT, AND LASER TRACKING STATION POSITIONS DERIVED FROM GEOS-1 AND GEOS-2 PRECISION REDUCED OPTICAL AND LASER OBSERVATIONS

J. G. Marsh, B. C. Douglas (Wolf Res. and Develop. Corp., Riverdale, Md.), and C. F. Martin (Wolf Res. and Develop. Corp., Riverdale, Md.) *In its* Proc. of the GEOS-2 Program Rev. Meeting, Vol. 1 Nov. 1970 p 187–214 refs (See N71-31826 19-13)

Avail: NTIS HC$6.00/MF$0.95 CSCL 08E

Coordinates for 23 NASA STADAN and SPEOPT optical and 2 NASA laser tracking sites were dynamically estimated from GEOS-1 and GEOS-2 data. To strengthen the solutions, SAO Baker-Nunn optical data were also used with the SAO station coordinates held fixed at their 1969 C8 values. Multiple 2-day arcs were used to minimize model error effects. An analysis of model error effects and comparison of results with those of SAO suggest an uncertainty of perhaps 5m north-south (latitude) and east-west (longitude) for most stations in North America. Height for the NAD sites, and latitude, longitude, and height elsewhere are uncertain by 10–15m in most cases. Author

N71-31835*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

NAD SURVEY ADJUSTMENTS FROM SHORT ARCS USING GEOS-1 OBSERVATIONS

F. M. Loveless, Jr. (DBA Systems, Inc., Lanham, Md.), J. J. Lynn (DBA Systems, Inc., Lanham, Md.) and John H. Berbert *In its* Proc. of the GEOS-2 Program Rev. Meeting, Vol. 1 Nov. 1970 p 215–232 refs (See N71-31826 19-13)

Avail: NTIS HC$6.00/MF$0.95 CSCL 08E

The practical value of deriving scale by orbital dynamics using GEOS-1 observations was investigated for 13 MOTS sites. The effects of errors in the gravity parameter, and errors in the assumed position of the fixed station on the precise determination of the position for the MOTS stations were determined. F.O.S.

N71-31836*# Air Force Cambridge Research Labs., Bedford, Mass. Terrestrial Sciences Lab.

IMPROVEMENT OF THE GEOS-1 NORTH AMERICAN TRACKING NETWORK FROM MULTIPLE SHORT ARC GEODETIC ADJUSTMENTS

George Hadgigeorge *In* NASA. Goddard Space Flight Center Proc. of the GEOS-2 Program Rev. Meeting, Vol. 1 Nov. 1970 p 233–266 refs *In its* Environ. Res. Papers No. 315 (See N71-31826 19-13)

(AFCRL-70-0090) Avail: NTIS HC$6.00/MF$0.95 CSCL 08E

Combinations of 171 passes were employed in a short arc geodetic adjustment to improve the survey coordinates of 29 observing stations. The recovery of the station positions and their standard errors along with other geodetic parameters are presented. The results of this adjustment show a mean standard error of approximately 3.5 meters, and corrections to NAD survey coordinates basically consistent with the observation network with the origin at Hunter AFB. Author

N71-31837*# Ohio State Univ., Columbus. Dept. of Geodetic Science.

ANALYSIS OF GEODETIC SATELLITE (GEOS 1) OBSERVATIONS IN NORTH AMERICA

Ivan I. Mueller, Charles R. Schwarz, and James P. Reilly *In* NASA. Goddard Space Flight Center Proc. of the GEOS-2 Program Rev. Meeting, Vol. 1 Nov. 1970 p 267–296 refs Submitted for publication Revised (See N71-31826 19-13)

(Grant NGR-36-008-093)

Avail: NTIS HC$6.00/MF$0.95 CSCL 08E

GEOS I observations made at thirty optical and four SECOR stations were analyzed in the geometric and short-arc modes for the purpose of detecting systematic distortions in the North American Datum. The results indicate that the NAD at its origin (Meades Ranch, Kansas) requires an easterly rotation in azimuth and a westerly rotation in the prime vertical plane, both in the magnitude of one second of arc to fit the satellite data. There is also evidence of the need for a reduction in scale of about 1:200,000. Author

N71-31840*# Ohio State Univ., Columbus. Dept. of Geodetic Science.

EXPERIMENTS WITH SECOR OBSERVATIONS ON GEOS-1

Ivan I. Mueller, James P. Reilly, Charles R. Schwarz, and Georges Blaha *In* NASA. Goddard Space Flight Center Proc. of the GEOS-2 Program Rev. Meeting, Vol. 1 Nov. 1970 p 347–362 refs (See N71-31826 19-13)

(Grant NGR-36-008-093)

Avail: NTIS HC$6.00/MF$0.95 CSCL 08E

The use of the SECOR observations on GEOS-1 satellite from the Pacific Tracking Network was studied to attach the network to NAD. By using inner adjustment equations, a standard deviation of a single range observation of slightly more than five meters was obtained. It is concluded that as a result of a set of station coordinates that appear reasonable, some of the data that was deleted should be re-examined by performing short-arc orbital mode adjustments to strengthen the network. F.O.S.

N71-31841*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

COMPARISONS OF INDEPENDENT INVESTIGATOR'S SURVEY ADJUSTMENTS ON THE NAD USING GEOS DATA

John H. Berbert and F. M. Loveless, Jr. (DBA Systems, Inc., Lanham, Md.) *In its* Proc. of the GEOS-2 Program Rev. Meeting, Vol. 1 Nov. 1970 p 363–370 refs (See N71-31826 19-13)

Avail: NTIS HC$6.00/MF$0.95 CSCL 08E

Four independent investigations of GEOS station survey adjustments on the North American Datum (NAD) were reported at or shortly after the National Spring Meeting of the AGU in April, 1969. Since the different investigators reported their results in different coordinate systems and relative to different initial surveys, it was not evident to what extent their adjustments agreed. To determine the extent of agreement, the survey adjustments were compared relative to a standard set of initial positions for 9 stations common to the above investigations. It was discovered that about 10% of the MOTS data used in the above survey adjustments were subject to a small systematic computer programming error. The corrected MOTS data were obtained from the NSSDC and used to repeat the GSFC survey adjustment to determine the effect of the error on the solutions. Author

N71-31843*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

PROCEEDINGS OF THE GEOS-2 PROGRAM REVIEW MEETING. VOLUME 2: TRACKING SYSTEM INTERCOMPARISONS WITH GEOS-2

Nov. 1970 214 p refs Conf. held at Greenbelt, Md., 22–24 Jun. 1970 Prepared in cooperation with Computer Sci. Corporation, Falls Church, Va.

(NASA-TM-X-67272) Avail: NTIS CSCL 08E

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2. CARNARVON LASER COLLOCATION EXPERIMENT (CALACO) J. M. Hlavin (RCA Service Co., Inc.), and J. H. Berbert p 11–24 refs (See N71-31845 19-16)

3. LASER/LASER COMPARISONS FROM THE GORF, ARLACO, AND GOLACO TESTS J. H. Berbert, J. M. Hlavin (RCA Service Co., Inc.), and R. F. Reich (RCA Service Co., Inc.) p 26–44 refs (See N71-31846 19-16)

4. REFRACTION STUDIES USING THE WICE DATA J. Mallinckrodt, H. Parker, and J. Berbert p 45–58 ref (See N71-31847 19-13)

5. GEOS-2 QUALITY ASSURANCE AND DATA VALIDATION J. Casto, M. Hlavin (RCA Service Co., Inc.), R. Reich (RCA Service Co., Inc.), and J. Berbert p 59–66 (See N71-31848 19-13)

6. IONOSPHERIC CORRECTIONS BASED ON VHF RANGE AND RANGE RATE MEASUREMENTS P. E. Schmid, S. Rangaswamy (Natl. Acad. of Sci.), and C. W. Murray, Jr. p 67–98 refs (See N71-31849 19-13)

7. A TWO LASER COLLOCATION EXPERIMENT M. R. Pearlman, C. G. Lehr, G. M. Mendes, and M. R. Wolf p 99–114 refs (See N71-31850 19-16)

8. MINITRACK SELF CALIBRATION J. Oosterhout and D. Harris p 115–124 (See N71-31851 19-13)

9. AN INTERCOMPARISON OF NAVY TRANET DOPPLER DATA AND OPTICAL DATA FROM THE GEOS-1 SATELLITE R. W. Agreen and J. G. Marsh p 129–194 refs (See N71-31852 19-13)

10. GLOBAL C-BAND RADAR NETWORK CALIBRATION UTILIZING GEOS-2 SATELLITE R. L. Brooks (Wolf Res. and Develop. Corp., Riverdale, Md.) and H. R. Stanley (NASA, Wallops Station, Wallops Island, Va.) p 195–216 refs (See N71-31853 19-13)

11. THE JUPITER CAMERA INTERCOMPARISON TEST F. G. Rawlinson, D. W. Harris, J. H. Berbert, and J. D. Oosterhout p 217–222 (See N71-31854 19-14)

12. GEOS-1 AND GEOS-2 MOTS CAMERA OPERATIONS, DATA ANALYSIS AND EXPERIMENTS D. W. Harris p 223–226 (See N71-31855 19-14)

N71-31847*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

REFRACTION STUDIES USING THE WICE DATA

J. Mallinckrodt, H. Parker, and J. Berbert *In its* Proc. of the GEOS-2 Program Rev. Meeting, Vol. 2 Nov. 1970 p 45–58 ref (See N71-31843 19-13)

Avail: NTIS CSCL 08E

Comparisons of various refraction correction formulas and data sources which cause variations in refraction data are summarized based on the GEOS-2 Wallops Island collocation experimental data. Ionospheric error analyses are reviewed including composite ionospheric profiles, profile comparisons with 2-frequency SECOR corrections, comparisons between SECOR and TRANET multifrequency corrections, geographical variation predictions, and Alouette determination of spatial variations. J.M.

N71-31848*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

GEOS-2 QUALITY ASSURANCE AND DATA VALIDATION

J. Casto, M. Hlavin (RCA Service Co., Inc.), R. Reich (RCA Service Co., Inc.), and J. Berbert *In its* Proc. of the GEOS-2 Program Rev. Meeting, Vol. 2 Nov. 1970 p 59–66 (See N71-31843 19-13)

Avail: NTIS CSCL 08E

The current status of the validation effort for GEOS-2 information collected by the Goddard Range and Range Rate (GRARR) systems and by the Minitrack Optical Tracking System (MOTS) is described. A brief description is presented of the utilization of data from these systems for quality assurance on the tracking performance of the STADAN. Author

N71-31849*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

IONOSPHERIC CORRECTIONS BASED ON VHF RANGE AND RANGE RATE MEASUREMENTS

P. E. Schmid, S. Rangaswamy (Natl. Acad. of Sci.), and C. W. Murray, Jr. *In its* Proc. of the GEOS-2 Program Rev. Meeting, Vol. 2 Nov. 1970 p 67–98 refs (See N71-31843 19-13)

Avail: NTIS CSCL 08E

The interpretation of radio tracking data which leads to a bias in range and range rate computed from the data if one assumes that the radio signals travel with freespace velocity is discussed. The propagation bias due to the ionospheric plasma is directly proportional to the number of electrons along the ray path linking the vehicle and tracking station. Consideration of appropriate equations for GEOS-2 ionospheric corrections led to the conclusion that the integrated electron content can be extracted directly from VHF tracking data. The theoretical aspect of this unique ionospheric correction scheme is outlined. Experimental verification based on analysis of Goddard range and range rate VHF tracking data is presented. Author

N71-31851*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

MINITRACK SELF CALIBRATION

J. Oosterhout and D. Harris *In its* Proc. of the GEOS-2 Program Rev. Meeting, Vol. 2 Nov. 1970 p 115–124 (See N71-31843 19-13)

Avail: NTIS CSCL 08E

Minitrack and MOTS tracking system camera observations of the GEOS-2 satellite covering the period in 1968 from February 21 to March 27 were used to test the feasibility of a self calibration update scheme using the NONAME orbit generator program to solve for the Minitrack zero sets. Initial estimates of phase bias were arbitrarily set at zero when, in fact, they might be up to + or − 180 deg for a given baseline. The solutions for minitrack zero sets converged to a set of incorrect values, and the simultaneously determined orbital parameters exhibited corresponding errors. Although negative results are indicated, minitrack self calibration feasibility is still in question. J.M.

N71-31852*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

AN INTERCOMPARISON OF NAVY TRANET DOPPLER DATA AND OPTICAL DATA FROM THE GEOS-1 SATELLITE

Russell W. Agreen and James G. Marsh *In its* Proc. of the GEOS-2 Program Rev. Meeting, Vol. 2 Nov. 1970 p 129–194 refs (See N71-31843 19-13)

Avail: NTIS CSCL 08E

Orbital solutions for the GEOS-1 satellite obtained from U.S. Navy TRANET Doppler data and those from optical flash data recorded by the NASA Space Tracking and Data Acquisition Network and Smithsonian Astrophysical Observatory systems were intercompared. The orbital arcs used were two days in length and were in the period July 9 through August 7, 1966. The rms of fits for the orbital solutions were on the order of 1.9 seconds of arc for the optical solutions and 2.7 cm/sec for the Doppler solutions. Comparisons of the corresponding optical and Doppler orbital ephemerides showed total rms position differences ranging from 20 to 40 meters. Biases in the base frequency value of the Doppler data were solved for; consistent biases in the base frequency around 9 cm/sec + or − 3 cm/sec were found. Author

N71-31853*# National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.

GLOBAL C-BAND RADAR NETWORK CALIBRATION UTILIZING GEOS-2 SATELLITE

Ronald L. Brooks (Wolf Res. and Develop. Corp., Riverdale, Md.) and H. Raymond Stanley *In its* Proc. of the GEOS-2 Program Rev. Meeting, Vol. 2 Nov. 1970 p 195–216 refs (See N71-31843 19-13)

Avail: NTIS CSCL 08E

A calibration project for the C-band radar network is described. The project objectives, unique data processing problems, and accomplishments are summarized. Recommendations are presented for future radar calibration projects. Author

N71-31856*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

PROCEEDINGS OF THE GEOS-2 PROGRAM REVIEW MEETING. VOLUME 3: LASER AND RADAR INVESTIGATIONS

Nov. 1970 216 p refs Conf. held at Greenbelt, Md., 22-24 Jun. 1970 Prepared in cooperation with Computer Sci. Corp., Falls Church, Va.

Avail: NTIS CSCL 08E

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2. AFCRL LASER-SATELLITE GOEDESY AND FUTURE PLANS R. L. Iliff (AFCRL, Badford, Mass.) p 43–50 (See N71-31858 19-13)

3. A PHOTOGRAPHIC TECHNIQUE FOR IMPROVED LASER-RANGING ACCURACY C. G. Lehr, M. R. Pearlman and J. L. Scott (Smithsonian Astrophy. Obs., Cambridge, Mass.) p 51–66 refs (See N71-31859 19-14)

4. SOME COMMENTS ON THE PRESENT AND FUTURE VALUE OF GEOMETRIC SATELLITE GEODESY K. Lambeck (Smithsonian Astrophy. Obs., Cambridge, Mass.) p 67–100 refs (See N71-31860 19-13)

5. GODDARD MOBILE LASER (MOBLAS) SYSTEM DESCRIPTION D. A. Premo p 101–114 (See N71-31861 19-16)

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7. GEODETIC SURVEY IMPROVEMENT WITH C-BAND RADAR D. R. Pfingsten (RCA Intern. Service Corp) p 145–166 (See N71-31863 19-07)

8. ACOUSTIC DATA REDUCTION AND CALIBRATION FOR THE GEOS-2 C-BAND RADAR MARINE GEODESY EXPERIMENT IN THE BAHAMAS A. G. Mourad, A. T. Hopper, D. M. Fubara, and G. T. Ruck (Battelle Memorial Inst., Columbus, Ohio) p 167–188 refs (See N71-31864 19-07)

9. NEAR REAL TIME RADAR CALIBRATION N. Bush (Pan Am. World Airways, Inc., Patrick AFB, Fla.) p 189–200 refs (See N71-31865 19-07)

10. SHIP BORNE RADAR TRACKING FOR PRECISE SHIP POSITIONING C. F. Martin (Wolf Res. and Develop. Corp., Riverdale, Md.) and W. B. Krabill (NASA, Wallops Station, Wallops Island, Va.) p 201–221 (See N71-31866 19-07)

N71-31858*# Air Force Cambridge Research Labs., Bedford, Mass. Terrestrial Sciences Lab.

AFCRL LASER-SATELLITE GEODESY AND FUTURE PLANS

Robert L. Iliff *In* NASA. Goddard Space Flight Center Proc. of the GEOS-2 Program Rev. Meeting, Vol. 3 Nov. 1970 p 43–50 (See N71-31856 19-13)

Avail: NTIS CSCL 08E

The instrumentation of a system for laser-satellite geodesy is described. The system is a dual laser concept to obtain range using a Q switched laser and to obtain angular information by photographic reflected high energy normal mode laser pulses against stellar fields. The Q switched laser system is capable of obtaining up to ten range measurements in a single pumping period which increases the confidence in returns, especially in the presence of high noise. Satellite range measurements were made using only satellite position predictions. Author

N71-31860*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
SOME COMMENTS ON THE PRESENT AND FUTURE VALUE OF GEOMETRIC SATELLITE GEODESY
K. Lambeck *In* NASA. Goddard Space Flight Center Proc. of the GEOS-2 Program Rev. Meeting, Vol. 3 Nov. 1970 p 67–100 refs (See N71-31856 19-13)
(Grant NGR-09-015-002)
Avail: NTIS CSCL 08E

The present status and future requirements of satellite geodesy using simultaneous optical direction observations are discussed. The accuracy of the system, and the use of various combinations of lasers and cameras from two stations are described, and the mathematics of an optimization of parameters for simultaneous range and direction observations is developed. The satellite-station configurations, direction observations, repitition rates, and interpolation methods which must be considered are specified.
N.E.N.

N71-31867*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PROCEEDINGS OF THE GEOS-2 PROGRAM REVIEW MEETING. VOLUME 4: GENERAL
Nov. 1970 282 p refs Conf. held at Greenbelt, Md., 22–24 Jun. 1970 Prepared in cooperation with Computer Sciences Corp., Falls Church, Va.
(NASA-TM-X-67269) Avail: NTIS CSCL 08E

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2. THE ORBIT OF PAGEOS THROUGH MARCH 1970 B. Chovitz and J. Lucas (Coast and Geodetic Surv., Rockville, Md.) p 11–30 refs (See N71-31869 19-30)

3. RADIATION PRESSURE EFFECTS ON THE ACCELERATION OF HIGH ALTITUDE BALLOON SATELLITES D. E. Smith and K. H. Fea (London Univ.) p 31–56 refs (See N71-31870 19-30)

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9. PLANS BY SAO FOR THE USE OF GEOS C IN GEODETIC AND EARTH-PHYSICS INVESTIGATIONS C. A. Lundquist and G. C. Weiffenbach (Smithsonian Astrophy. Obs.) p 171–182 refs (See N71-31876 19-13)

10. SOME RESULTS OF A SHORT-ARC, ORBIT-DETERMINATION STUDY RELATED TO THE GEOS-C ALTIMETER EXPERIMENT R. M. L. Baker, Jr., D. Ourston, and N. H. Schroeder p 183–240 (See N71-31877 19-13)

11. ALTIMETER BIAS RECOVERY FROM RANGE AND ANGLE OBSERVATIONS J. Berbert and F. Loveless (DBA Systems, Inc., Lanham, Md.) p 241–252 refs (See N71-31878 19-14)

12. MSFN UNIFIED S-BAND METRIC TRACKING CAPABILITIES I. Salzberg p 253–268 (See N71-31879 19-07)

13. MISTRAM APPLICATIONS WITH GEOS C N. Bush (Pan Am. World Airways, Inc., Patrick AFB, Fla.) p 269–280 (See N71-31880 19-07)

14. GEOS-C RADAR ALTIMETER J. W. Bryan p 281–292 (See N71-31881 19-07)

N71-31871*# Aeronautical Chart and Information Center, St. Louis, Mo.
AIR FORCE USE OF GEODETIC SATELLITE DATA
H. Leroy Kuykendall *In* NASA. Goddard Space Flight Center Proc. of the GEOS-2 Program Rev. Meeting, Vol. 4 Nov. 1970 p 57–68 (See N71-31867 19-13)
Avail: NTIS CSCL 08E

The dynamic application of the GSP data is concerned primarily with the determination of an earth gravitational model and tracking station location from a combination of Baker-Nunn and Doppler data supplemented with existing surface gravity anomalies. To date, Kaula's analytic procedures have been used for computing an earth gravitational model.
Author

N71-31872*# Hawaii Inst. of Geophysics, Honolulu.
NATIONAL GEODETIC SATELLITE PROGRAM (NGSP) STATION SOLUTIONS
A. Mancini, L. Gambino, J. Reece (Geonautics, Inc.), and J. Richardson (Geonautics, Inc.) *In* NASA. Goddard Space Flight Center Proc. of the GEOS-2 Program Rev. Meeting, Vol. 4 Nov. 1970 p 69–96 refs (See N71-31867 19-13)
(Contract NSR-12-001-055)
Avail: NTIS CSCL 08E

The results of a National Geodetic Satellite Program (NGSP) geodetic, short-arc solution from optical observations of Pageos are reported. The simultaneous, short-arc adjustments produced excellent results. Observations used in this solution included all BC-4 camera data on the Pageos satellite. The observations were collected from the Phase I sites and were finally reduced according to procedures given in a reference. The satellite directions are given for each image of the traces in terms of apparent right ascension and declination uncorrected for satellite parallax, phase angle, and aberration. The observational time is given in UT-1 system with corrections applied to refer the time to the adopted longitude of NAD relative to the Naval Observatory.
Author

N71-31874*# DBA Systems, Inc., Melbourne, Fla.
GEOCEIVER AS A RANGING SYSTEM
Duane C. Brown *In* NASA. Goddard Space Flight Center Proc. of the GEOS-2 Program Rev. Meeting, Vol. 4 Nov. 1970 p 107–164 refs (See N71-31867 19-13)
Avail: NTIS CSCL 08E

The Geoceiver is regarded as providing a measure of the change in slant range over preset readout intervals of nominally one minute. Ranging observational equations involving an additional unknown parameter for each pass consisting of the range of the satellite at the initiation of cycle counting are considered. The ranging approach also takes into account constrained parameters such as: drifts in satellite and Geoceiver frequencies, the bias in the adopted value of the satellite frequency, and residual tropospheric refraction. Reduction of a set of 14 passes of a navigational satellite observed by a prototype Geoceiver not only establishes the technical soundness of treating Geoceiver as a ranging system but also demonstrates that the standard deviation of Geoceiver ranging observations is on the order of 0.10 meter. Numerical simulations employing this figure indicate that when the ranging approach is adopted, a strong short arc net of Geoceivers operating over a period of only two days can be expected to recover coordinates of participating stations to within a few tenths of a meter over regions of continental extent.
Author

N71-31875*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GEOS-C PLANS

Robert M. Rados *In its* Proc. of the GEOS-2 Program Rev. Meeting, Vol. 4 Nov. 1970 p 165–170 (See N71-31867 19-13)
Avail: NTIS CSCL 08E

A summary of the constraints and the proposed instrumentation for GEOS-C is presented. The radar altimeter is the prime system and the major change to GEOS 1 and 2. The so called bare bones spacecraft will contain, in addition to the altimeter, two flashing lights, laser reflector panels, two C-band transmitters, Tranet, as in GEOS 2 and a unified S band transponder which, like the radar altimeter, will be new to GEOS. The spacecraft will have two axis stabilization as in GEOS 2, PCM for telemetry, a new command format, an updated power system to provide increased capability, and an attitude determination system to provide data for evaluation of the radar altimeter. Author

N71-31876*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
PLANS BY SAO FOR THE USE OF GEOS C IN GEODETIC AND EARTH-PHYSICS INVESTIGATIONS
Charles A. Lundquist and George C. Wolffenbach *In* NASA. Goddard Space Flight Center Proc. of the GEOS-2 Program Rev. Meeting, Vol. 4 Nov. 1970 p 171–182 refs (See N71-31867 19-13)
Avail: NTIS CSCL 08E

At the Smithsonian Astrophysical Observatory (SAO), investigations based on satellite tracking stress topics of a comprehensive, global character. Using data related to the GEOS-C project, the observatory hopes to investigate a comprehensive range of geodetic and earth-physics topics: details of the geopotential, the ocean geoid, time dependence of the geopotential, polar motion, the rotation of the earth, and other subjects. A comprehensive, integrated examination of these topics is a desirable ingredient of plans for the Geos-C project. Author

N71-31877*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOME RESULTS OF A SHORT-ARC, ORBIT-DETERMINATION STUDY RELATED TO THE GEOS-C ALTIMETER EXPERIMENT
Robert M. L. Baker, Jr. Dirk Ourston, and Norman H. Schroeder *In its* Proc. of the GEOS-2 Program Rev. Meeting, Vol. 4 Nov. 1970 p 183–240 (See N71-31867 19-13)
Avail: NTIS CSCL 08E

Studies have been accomplished that have dealt with short arc orbit determination if the satellite traverses less than one radian on its orbit and is visible from three or more designated radar sensors over the entire arc. Both of these requirements are satisfied in the Caribbean area for the nominal GEOS-C orbit and for arcs of 5,000 km or less. Short arc studies indicate that force model, observational, and station location errors do not completely render satellite altimeter data useless; these errors do not mask the results of an altimeter test over a 1000 km or so ocean subsatellite track. Author

N71-31895# Weidlinger (Paul) Consultants, New York.
A SUMMARY OF SOME ANALYTICAL STUDIES ON AIRBLAST INDUCED GROUND MOTIONS
Melvin L. Baron Mar. 1971 71 p refs
(Contract DASA01-69-C-0130)
(AD-723209; DASA-2634) Avail: NTIS CSCL 8/13

The current requirements for predicting ground shock effects in the relatively high pressure regions of nuclear explosions have necessitated the development of suitable mathematical models for the geological materials which make up the media. The use of these more complicated models in the study of ground shock effects have necessitated the development of a group of analytical and semi-analytical check solutions for the various materials of interest. This paper presents a summary of a group of such solutions, together with a bibliography. The solutions, while of interest in themselves, have been extensively used as check solutions for the various large computer codes which have been developed for the study of ground shock effects from nuclear and high explosive sources. Author (GRA)

N71-31927# Aeronautical Chart and Information Center, St. Louis, Mo. Technical Library Section.
THE PROBLEM OF REDUCING THE FORMULA DESCRIBING THE SHAPE OF THE EARTH TO A TAYLOR SERIES [K VOPROSU PRIVEDENIYA FORMULY, OPREDELYAYUSHCHEY FIGURU ZEMLI, K RYADU TEYLORA]
M. I. Marych Nov. 1970 11 p refs Transl. into ENGLISH from Geod. Kartografiya i Aerofotosyemka (Lvov), v. 9, 1969 p 29–32
(AD-723515; ACIC-TC-1679) Avail: NTIS CSCL 8/5

Molodenskiy has suggested a new method of solving his integral equation for the density of a simple layer and has obtained formulas for successive approximations of the disturbing potential on the physical surface of the earth. If the earths physical surface on which the gravity anomalies are given is assumed to be a sphere, then the disturbing potential will be determined by Stokes formula. This paper shows an attempt to obtain this result using the Molodenskiy method of successive approximations, and also the method of transformations by expanding the disturbing potential in a Taylor series. Author (GRA)

N71-31928# Institut Royal Meteorologique de Belgique, Brussels.
GEOPHYSICAL OBSERVATIONS Monthly Bulletin, Jul. 1970 [OBSERVATIONS GEOPHYSIQUES Bulletin Mensuel, Juillet 1970]
1970 27 p In FRENCH and DUTCH
Avail: NTIS

Geophysical data obtained at Dourbes (Belgium) relating to geomagnetism, air radioactivity, ionospheric parameters, seismology, atmospheric electricity, and cosmic rays during July 1970 are presented. ESRO

N71-31936# Aerospace Research Labs, Wright-Patterson AFB, Ohio.
ELECTROMAGNETIC DISTURBANCES DUE TO ATMOSPHERIC TURBULENCE Final Report
David A. Lee Dec. 1970 31 p refs
(AD-723312; ARL-70-0265) Avail: NTIS CSCL 4/1

The report presents the results of a preliminary study of electromagnetic disturbances caused by the motion of a charged fluid, with an eye to detecting clear air turbulence. Three models were considered: isolated turbulence in a homogeneously charged fluid, a coherent wave motion of a homogeneously charged fluid, and a wave motion of a strongly charged sheet in an uncharged region. It is concluded that detection of the fields produced by the isolated turbulence model may be just possible if statistical detection techniques are used. A ground-based magnetic detector appears to be best suited to detecting electromagnetic disturbances produced by this sort of turbulence. Author (GRA)

N71-31965# Center for the Environment and Man, Inc., Hartford, Conn.
A COST EFFECTIVENESS METHODOLOGY FOR ENVIRONMENTAL DATA COLLECTION SYSTEMS, PHASE 3 Final Report
Gaylord M. Northrop, Earl L. Davis, Edward R. Sweeton, and Fletcher L. Tholomew 31 Dec. 1970 209 p refs
(Contract DOT-CG-02006-A)
(AD-722596, CEM-4053-430) Avail: NTIS CSCL 8/10

The report summarizes the accomplishement of the following three Objectives: Develop a versatile computerized cost effectiveness

(CE) model that is applicable to National Data Buoy Systems and other national marine environmental data collection systems; Obtain for use with the CE model quantified expert judgement concerning data users requirements and estimates of data collection system performance and costs; Demonstrate the applicability of the improved CE model to analysis of postulated data collection system concepts, including data buoys in a system mix with other data collection platforms. It describes the activities that have been performed in developing a computerized CE Methodology embracing extensive use of quantified expert judgment and tailored specifically to serve as an aid in project decision making. Author (GRA)

N71-32003# Joint Publications Research Service, Washington, D.C.
OCEANOGRAPHY
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 256 15 Jul. 1971 p 10–14 refs (See N71-32000 19-30)
Avail: NTIS

The methods used to measure the light scattering matrix of sea water and backscattering signals from turbid medium are discussed. Also discussed are internal wave measurements and probability density distribution of current velocity components of the ocean. E.H.W.

N71-32004# Joint Publications Research Service, Washington, D.C.
TERRESTRIAL GEOPHYSICS
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 256 15 Jul. 1971 p 15–25 refs (See N71-32000 19-30)
Avail: NTIS

An explosive seismology method for studying the earth's crust, the upper mantle, and regional geophysical fields is discussed. The method provides a way to classify deep faults dividing the earth's crust into blocks, detect lateral differentiation of matter in the upper mantle, classify layered blocked structure of mantle, establish some important relationships between elements of deep crustral and mantle structure, and ascertain the pattern of distribution of minerals. In addition, a radioastronomical method for measuring distances between continents is given. E.H.W.

N71-32005# Joint Publications Research Service, Washington, D.C.
UPPER ATMOSPHERE AND SPACE RESEARCH
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 256 15 Jul. 1971 p 26–53 refs (See N71-32000 19-30)
Avail: NTIS

A review of the events leading to the launching of the first manned Russian spacecraft and the problems faced by the launch is presented. The effects of weightlessness, great acceleration during launching and descent, and cosmic radiation are examined. A detailed description of the activities and biomedical experiments made on the Salyut is given. E.H.W.

N71-32030# Defense Documentation Center, Alexandria, Va.
AIR POLLUTION, PARTICULATE MATTERS, VOLUME 1 Report Bibliography, Oct. 1942–Dec. 1970
May 1971 133 p refs
(AD-723900; DDC-TAS-70-90-1-Vol-1) Avail: NTIS CSCL 13/2

The annotated references in the bibliography pertain to the analysis of atmospheric aerosols and particulate matters; specifically particle size, measurement, distribution, and identification of pollutants; the atmospheric motion of aerosol particles such as scattering, settling, diffusion, and transport properties, and other topics such as volcanic dust and pollens. The report contains 98 citations with abstracts. The data searched covers from 1953 to March 1971. The computer-generated indexes include Subject and Personal Author. GRA

N71-32031# Military Research and Development Center, Bangkok (Thailand).
IONOSPHERIC DATA REPORT, OCTOBER 1970
Oct. 1970 38 p
(AD-723/63; MRDC-70-010) Avail: NTIS CSCL 4/1

Ionospheric observations are being carried out at the Operations Room, Vertical-Incident Sounder Site, located at the Applied Scientific Research Corporation of Thailand, Bangkok 9, Thailand. Data are being taken with a modified model C-2 Vertical-Incident Sounder. Author (GRA)

N71-32114# Environmental Research Corp., Las Vegas, Nev.
OBSERVED SEISMIC DATA, CALABASH EVENT
Lewis R. West and Raymond K. Christie, comps. Feb. 1971 66 p refs
(Contract AT(29-2)-1163)
(NVO-1163-218) Avail: NTIS

Results of the processing of the observed ground motions for an underground nuclear detonation on Yucca Flat, at the Nevada Test Site are presented. Pseudo-relative velocity spectra at 5% damping were derived from the velocity seismograms. Author (NSA)

N71-32115# Blume (John A.) and Associates Research Div., San Francisco, Calif.
STRUCTURAL RESPONSE STUDIES FOR PROJECT RULISON
Feb. 1971 183 p refs
(Contract AT(26-1)-99; Proj. Rulison)
(JAB-99-78; PNE-R-46) Avail: NTIS

Project RULISON, an experiment using an underground nuclear explosive to fracture and thereby increase production from a gas-bearing sandstone, was detonated in western Colorado. Comprehensive structural response investigations were required for the detailed prediction of response and damage to natural and man-made structures in the area, to eliminate hazards to the public and also to provide a quantitative assessment of probable damage repair cost. Initial analyses show correlation between response motion and damage occurrence, and further detailed analyses of the motion damage relationship are in progress. As of October 31, 1970, damage payments plus amounts offered in settlement of a few remaining claims totaled about $117,500. Author (NSA)

N71-32139# Mainz Univ. (West Germany). Meteorologisch-Geophysikalisches Inst.
RESEARCH ON ATMOSPHERIC OPTICAL RADIATION TRANSMISSION Scientific Report, 1 Jan. 1969–31 Dec. 1970
Reiner Eiden, Guenter Eschelbach, Gottfried Haenel, and Kurt Bullrich Jan. 1971 89 p refs
(Contract F61052-69-C-0016)
(AD-722538; AFCRL-71-0184; SR-1) Avail: NTIS CSCL 4/1

The report discusses the following items: A direct method for the integration of the equation of radiative transfer in a turbid atmosphere; Determination of the complex index of refraction of spherical aerosol particles optimal information is obtained of the light scattered by analysing the degree of polarization, the ellipticity and the angle of orientation of the ellipse of the field vector; New results on visual range as function of relative humidity have indicated that there exists a simple relation between the change in visual range and change of particle radius; and, Calculations of the spectral extinction coefficient of stmospheric aerosol particles with different complex refractive indices. Author (GRA)

N71-32148*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
UPWELLING STUDIES WITH SATELLITES
Karl-Heinz Szekielda Jul. 1971 20 p refs Submitted for publication

(NASA-TM-X-65643; X-651-71-298) Avail: NTIS CSCL 08C

Recent investigations with satellites over upwelling areas are presented. Using different techniques (as color enhancement and multispectral methods) the dynamics of upwelling water in connection with the Somali Current, the Canary Current, the Benguela, and the Agulhas Current were analyzed. Studies in the Somali Current revealed a very fast response time of the cold water onto the onset of the Southwest Monsoon. Separated cold patches were detected in the Somali upwelling area and along the Northwest Coast of Africa. They are probably produced by varying wind action. The radiation temperatures along the southwest and southeast coast of Africa showed the appearance of upwelling in connection with the Agulhas Current and the Benguela Current. Both areas are separated by the warm water from the Agulhas Current which leaves the coast in southwest direction at about 34 S. Author

N71-32149*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

IMP 5 MAGNETIC FIELD MEASUREMENTS IN THE HIGH LATITUDE OUTER MAGNETOSPHERE NEAR THE NOON MERIDIAN

D. H. Fairfield and N. F. Ness Jul. 1971 35 p refs Submitted for publication

(NASA-TM-X-65642; X-692-71-295) Avail: NTIS CSCL 08N

Magnetic field measurements of the IMP 5 at geomagnetic latitudes up to 75 deg and at distances beyond 6 R sub E reveal the permanent existence of a broad depressed field region centered on the polar or dayside cusp. Field strengths at 7 R sub E on cusp field lines which connect to the earth are typically only 50–70% that of an undistorted dipole field. The transition region between the magnetosheath and the point where the fields are clearly of dipolar origin is characterized by large amplitude fluctuations and the lack of a clear magnetopause boundary. Magnetic field perturbations are observed in the cusp region with magnitudes up to 45 gamma and in directions which are approximately perpendicular to the average field. These perturbations are suggestive of field aligned currents and their magnitudes are consistent with the low altitude measurements obtained on low altitude polar orbiting spacecraft. Author

N71-32152# Washington Univ., Seattle. Dept. of Oceanography.

TECHNICAL REPORTS FROM THE DEPARTMENT OF OCEANOGRAPHY, UNIVERSITY OF WASHINGTON, 1950–1971

Apr. 1971 32 p refs Sponsored by ONR

(AD-723840; A71-11) Avail: NTIS CSCL 8/1

The report is a bibliography of scientific research in oceanography completed by the University of Washington, Washington, State; and sponsored by the office of Naval research. GRA

N71-32204# Lowell Technological Inst. Research Foundation, Mass.

DESIGN, DEVELOP AND FABRICATE AN IONOSPHERIC SOUNDING SYSTEM USING DIGITAL PHASE-COHERENT INTEGRATING TECHNIQUES Final Report, 15 May 1968–31 Dec. 1970

Klaus Bibl, Joseph A. Patenaude, Bodo W. Reinisch, and Richard Vargas-Vila Dec. 1970 259 p

(Contract F19628-68-C-0267)

(AD-723290; LTIRF-323/IP; AFCRL-71-0001) Avail: NTIS CSCL 4/1

Many years experience in ionospheric physics as well as design and operation of ionospheric sounders were the basis for creation of the Digisonde 128. By implementing the latest achievements in state of the art technology and recent advancements in solid state analog components and digital arrays, a technically sophisticated ionosonde has been realized. The main feature of the Digisonde 128 is the continuous monitoring of the ionosphere by vertical pulse sounding in a large frequency range. GRA

N71-32240# Arizona Univ., Tucson. Inst. of Arid Lands Research.

DESERT RESEARCH, 2: SELECTED REFERENCES 1966–1970

Patricia Paylore, comp. Sep. 1970 173 p refs *Its* Ser. ES-60

(Contract DAAG17-67-C-0199)

(AD-723062; TR-71-20-ES) Avail: NTIS CSCL 8/6

The report consists of 594 references to worldwide desert literature appearing between 1966 and 1970, as located during the period January 1969 to August 1970 in standard abstracting and indexing tools, by continuing searches in sources not so indexed, and by a worldwide network of direct contacts. It is arranged alphabetically by authors, with a brief index of subject geographic terms. Brief abstracts are included, with emphasis on arid lands aspects of such topics as geomorphology, weather and climate, vegetation, fauna, surface materials, hydrology, and geography. Author

N71-32250# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

Cf 252 NEUTRON ACTIVATION FOR TERRESTRIAL, SEA FLOOR, AND POSSIBLE PLANETARY SURFACE ANALYSIS

R. W. Perkins, W. A. Haller, and H. G. Rieck 1971 15 p refs Presented at the Meeting on Neutron Sources and Appl., Augusta, Ga. Sponsored by AEC

(BNWL-SA-3803; Conf-710402-2) Avail: NTIS

The high neutron emission rates presently available from Cf-252 sources have dramatically improved the potential applications of both laboratory and in situ neutron activation analyses of minerals. In recent laboratory studies of 200-lb ore samples, techniques were developed that permit the very rapid analysis of more than 16 elements at concentrations that are generally well below those of commercial interest. These developments were based on studies conducted with 260-microgram and 1.8-mg Cf-252 sources for neutron activation and a 50-cc Ge(Li) diode for gamma spectrometric analysis. In feasibility studies carried out in several feet of water in an ocean tidal zone, it was demonstrated that elements such as Au, Ag, and Mn could be measured in concentrations as low as a few ounces per ton. The technology developed for either ground-based or shipboard laboratory mineral analysis, the technology and equipment being developed for in situ analysis of the floors of fresh and salt water basins, and the potential applications of this technology for planetary surface analysis are described. Author (NSA)

N71-32258# California Univ., Livermore. Lawrence Radiation Lab.

AIR POLLUTION: OUR ECOLOGICAL ALARM AND BLESSING IN DISGUISE

Hugh W. Ellsaesser Feb. 1971 6 p refs Presented at the 8th Space Congress Conf., Cocoa Beach Fla., 1 Apr. 1971 Sponsored by AEC

(UCRL-73063; Conf-710410-1) Avail: NTIS

The diagnosis of overgrazing, social and political problems, the call to switch battle standards, and air pollution as an indicator of man's abuse of his environment are discussed. J.M.

N71-32292*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE ELECTRON HEATING RATE AND ION CHEMISTRY IN THE THERMOSPHERE ABOVE WALLOPS ISLAND DURING THE SOLAR ECLIPSE OF 7 MARCH 1970

L. H. Brace, H. G. Mayr, M. W. Pharo, III, L. R. Scott, N. W. Spencer et al May 1971 36 p refs Submitted for publication

(NASA-TM-X-65638; X-621-71-273) Avail: NTIS CSCL 04A

An identical pair of thermosphere probes measured the N2 concentration and temperature, the ion composition and concentrations and the electron temperature up to 290 kilometers about 30 minutes and 5 minutes before totality during the March 7, 1970 eclipse at Wallops Island. The rockets travelled similar trajectories thus permitting the purely temporal changes between flights to be resolved. The neutral temperature and N2 concentration changed little but the electron temperature decreased by as much as 20% in the lower F-region. The ion concentration decreased by about 30% in the F-region and about 50% in the E-region, with little change in relative ion composition. The electron cooling rates decreased by a factor of 6 in the lower F-region, approximately in proportion to the change in visible solar disc. The ion composition measurements were consistent with solutions of the ion continuity equations. Author

N71-32367*# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.

LOCKHEED EXPERIMENT ON ATS-5 Quarterly Progress Report, 1 Mar. – 31 May 1971

R. D. Sharp 7 Jun. 1971 11 p

(Contract NAS5-10392)

(NASA-CR-19773; QPR-7) Avail: NTIS CSCL 03B

The magnetospheric substorm experiment on ATS-5 is continuing in its successful operation. A detailed study of individual isolated magnetospheric substorms is being made utilizing coordinated observations by several groups of experimenters. The study of the average properties of the ambient plasma is continuing. Author

N71-32391*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

MODEL FOR ROTATING AND NONUNIFORM PLANETARY EXOSPHERES

R. E. Hartle Aug. 1971 32 p refs Submitted for publication

(NASA-TM-X-65662; X-621-71-310) Avail: NTIS CSCL 03B

The model neutral exosphere with a uniformly rotating exobase is generalized by allowing variations in exobase density and temperature which characterize the thermosphere just below the base. The corresponding velocity distribution function, satisfying the collisionless Boltzmann equation, is constructed and used to form a general expression for the velocity moments. Resulting density profiles of rotating exospheres with nonuniform densities and temperatures on the exobase are compared with corresponding nonrotation exospheres. Density enhancements due to rotation are found to be greatest above regions of exobase density or temperature minima. Equatorial density enhancements of terrestrial hydrogen, resulting from rotation, are estimated to be 15 to 17 percent at altitudes of 10 to 20 earth radii. Corresponding increases in terrestrial helium are 30 to 50 percent on the equator at altitudes of 0.7 to 1 earth radii even when there is a polar density bulge in the barosphere. Author

N71-32413*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

A COMPARISON OF VLF AURORAL HISS WITH PRECIPITATING LOW ENERGY ELECTRONS USING SIMULTANEOUS DATA FROM TWO OGO-4 EXPERIMENTS

R. A. Hoffman and Thomas Laaspere Aug. 1971 30 p refs Submitted for publication

(NASA-TM-X-65665; X-646-71-319) Avail: NTIS CSCL 03B

To deduce the origin of auroral hiss, the records of a VLF experiment (0.3 to 18 kHz) were compared with simultaneous data obtained by an auroral particles experiment having detectors for precipitating electrons at 0.7, 2.3, and 7.3 keV. It was found that on the dayside of the earth, the occurrence of VLF hiss correlates well with precipitation events at 0.7 keV, but in general very poorly with activity in the higher-energy channels. Exact correlation between variations in VLF hiss intensity and in electron fluxes is rare even at 0.7 keV. In addition, VLF hiss tends to be observed over a somewhat larger spatial region than precipitating 0.7 keV electrons. It is concluded that on the dayside, auroral hiss is generated by soft (E < 1 keV) cusp region electrons and that the lack of detailed correlation between the two phenomena is caused by propagation effects as the hiss travels downward and spreads from the generation region. Author

N71-32418# Aerojet-General Corp., El Monte, Calif. Microwave Div.

A STUDY OF PASSIVE MICROWAVE TECHNIQUES APPLIED TO GEOLOGIC PROBLEMS Final Report, 1969 – 1970

A. T. Edgerton and D. T. Trexler Jul. 1970 268 p refs

(Contract DI-14-08-0001-11983)

(PB-198378; AGC-1361R-1; USGS-GD-71-012) Avail: NTIS CSCL 08G

The microwave properties of representative rocks and minerals are established and the possibility of using microwave radiometry for various geologic mapping problems is examined. Field investigations, conducted at numerous sites in the western United States, were performed with the use of a mobile field laboratory equipped with four dual-polarized radiometers operating at wavelengths 0.81, 2.2, 6.0, and 21 cm. The microwave brightness temperature measurements were used to determine the emissivities of several common rocks and minerals. Correlation was noted between the computed emissivities and physical characteristics of the materials, but no direct association was noted between the chemical composition of target materials and the computed emissivities. GRA

N71-32436*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

PLASMA PARAMETER beta IN THE MIDNIGHT MAGNETOSPHERE: FROM THE NEAR-EARTH PLASMA SHEET TO THE PLASMAPAUSE

Masahisa Sugiura Jul. 1971 20 p refs

(NASA-TM-X-65640; X-645-71-280) Avail: NTIS CSCL 04A

Rb magnetometer observations on OGO-B and estimates of plasma energy density based on proton and electron flux measurements on the same satellite, were used to evaluate plasma parameter beta (the ratio of plasma energy density to the magnetic field energy density), in the magnetosphere near midnight. The observations were made near the dipole equator. It was shown that near midnight, beta normally exceeded unity just outside the plasmapause even during magnetically quiet periods. Existence of a peak in beta near the inner edge of the high beta region appeared to be a part of the structure of this plasma region. The proton belt was not the main cause of the equatorial depression of the magentic field in the inner magnetosphere, because the distribution of DeltaB, defined as the deviation of the scalar B from the magnitude of a reference field, was entirely different from that expected from the proton belt. Both the radial distribution and the magnitude of beta were highly variable from one pass to the next over a time span of approximately two days. Author

N71-32438*+ National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md. Lab. for Space Physics.

HOURLY VALUES OF EQUATORIAL Dst, 1957 – 1970

M. Sugiura and D. J. Poros Jul. 1971 206 p refs

(NASA-TM-X-65645; X-645-71-278) Avail: NTIS CSCL 08N

A planetary magnetic activity index is presented on an hourly basis for use in studies of geophysical disturbance phenomena, particles and plasmas in the magnetosphere, solar-terrestrial relationships, and cosmic rays. The hourly equatorial Dst values for the years 1957 to 1970 are given. Author

N71-32442*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TURBULENCE OF ELECTROSTATIC ELECTRON CYCLOTRON HARMONIC WAVES OBSERVED BY ALOUETTE-2 AND OGO-5
Hiroshi Oya Jul. 1971 18 p refs Submitted for publication
(NASA-TM-X-65660; X-621-71-299) Avail: NTIS CSCL 03B

VLF emissions which have been observed near 3/2f sub H, 5/2f sub H, and 7/2f sub H by OGO-5 in the magentosphere, where f sub H is the electron cyclotron frequency, coincide with the most favorable point for long duration diffuse plasma resonances f sub Dn observed by Alouette-2 and ISIS-1. The f sub Dn are enhanced being associated with nonlinear wave particle interaction of the electrostatic electron cyclotron harmonic wave, including the instability in the turbulence. The difference between the two observations is only in the excitation mechanism of the turbulence; the turbulence in the plasma trough detected by OGO-5 is due to natural origins while the ionospheric topside sounder makes the plasma wave turbulence artificially by submitting strong simulation pulses. An electron density profile in the plasma trough is obtained by applying the f sub Dn–f sub N/f sub H relationship obtained from the Alouette 2 experiment; the values reveal a good coincidence with highly sensitive mass-spectrometer observations. Author

N71-32444# Coast Guard, Washington, D.C.
OCEANOGRAPHIC OBSERVATIONS IN BAFFIN BAY DURING JULY–SEPTEMBER 1968
Robin D. Muench, Martin J. Moyniham, Edward J. Tennyson, Jr, W. Gordon Tidmarsh, and Roger B. Theroux Feb. 1971 106 p refs
(PB-198355; USCG-373-37) Avail: NTIS CSCL 08J

Oceanographic conditions in Smith Sound, northern Baffin Bay, Disko Bay, and southeastern Baffin Bay during the summer of 1968 are described. Vertical sections of temperature and salinity are presented and the relationship of these variables to Baffin Bay - north water and the general circulation of Baffin Bay is discussed. Zooplankton collections in the Smith Sound region and macrobenthos collections in Disko Bay and several Western greenland fjords are reported on. Listings of the physical and chemical station data are included. Author (GRA)

N71-32477*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
SEVERAL COMMENTS CONCERNING A RECENTLY PROPOSED MAGNETOSPHERIC MODEL
L. A. Frank Nov. 1970 15 p refs
(Contract NAS5-9074)
(NASA-CR-119780; UI-70-57) Avail: NTIS CSCL 03B

Recent observations of the plasmas in the distant polar magnetosphere have been interpreted in terms of a new model of the magnetosphere. These measurements demonstrated that magnetosheath plasma gains direct access to the magnetosphere through two wide bands along the sunlit magnetopause at high latitudes, one each in the Northern and Southern hemispheres. The region in the sunlit magnetosphere to which the magnetosheath plasma has direct access is designated as the polar cusp. The spatial relationship of the polar cusp and the plasma sheet in the magnetotail is shown. Author

N71-32479*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md. Lab. for Planetary Atmospheres.
ELECTRON AND POSITIVE ION DENSITY ALTITUDE DISTRIBUTIONS IN THE EQUATORIAL D REGION
A. C. Aikin, R. A. Goldberg, and Y. V. Somayajulu (Natl. Phys. Lab., New Delhi, India) Aug. 1971 27 p refs
(NASA-TM-X-65655; X-625-71-308) Avail: NTIS CSCL 04A

Three simultaneous rocket measurements of D region ionization sources and electron and ion densities were made in one day. Electron density profiles for solar zenith angles of 53.2, 27.8 and 48.3 deg are displayed. The profiles are found to be quite similar to those reported for mid-latitudes under quiet conditions. Using simultaneous measurement of the X-ray flux together with NO ionization estimates based on recent measurements of NO by Meira (1971) and O2(1 Delta g) ionization rates by Huffman et al (1971), the ion pair production function is computed. It is demonstrated that the charged particle distribution can be explained using this production function and an effective recombination coefficient compatible with recent laboratory measurements of the dissociative recombination coefficient for electrons with hydrated cluster ions. uthor

N71-32499# Miami Univ., Fla. Rosenstiel School of Marine and Atmospheric Sciences.
STUDY OF TRITIATED HYDROGEN AND ITS COMPOUNDS IN THE ENVIRONMENT Progress Report
H. Goote Oestlund Mar. 1971 9 p refs
(Contract AT(40-1)-3944)
(ORO-3944) Avail: NTIS

Environmental monitoring activities from June 1970 to March 1971 for determining the He-3 and tritium water vapor content of ground level air, of the atmosphere to 31,000 ft, of rain, and of the environment near and within nuclear installations are described. Sampling equipment and methods used for tritium monitoring in the atmosphere near Miami, Florida and Fairbanks, Alaska are discussed and the results presented. NSA

N71-32501*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
POSITIVE ION COMPOSITION MEASUREMENTS IN THE D AND E REGIONS OF THE EQUATORIAL IONOSPHERE
Richard A. Goldberg Jul. 1971 23 p refs Presented at the COSPAR Symp. on D and E Region Ion Chem., Urbana, Ill., 6–8 Jul. 1971
(NASA-TM-X-65651; X-625-71-258) Avail: NTIS CSCL 04A

The equatorial D region positive ion composition has been studied with two rocket payloads. The observed distribution indicates no major variations from the measured midlatitude distribution. The data exhibit strong shock effects under ram sampling in the sense that heavy water clusters are dissociated to lighter mass values. Hence, wake sampled data are believed to provide a more realistic description of the ambient D region than ram sampled data. Author

N71-32519*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md. Lab. for Space Physics.
ANALOGY BETWEEN MAGNETOSPHERIC RESONANCE AND THE VIBRATION OF A STRINGED MUSICAL INSTRUMENT
Masahisa Sugiura Jul. 1971 15 p refs
(NASA-TM-X-65644; X-645-71-279) Avail: NTIS CSCL 03B

The production of resonant oscillations of the earth's magnetic field is discussed using as an analogy a violin playing. The magnetosphere resonates as the body of the violin and the solar wind acts as the bow. The frictional force assumed to produce a drag that drives the convection in the magnetosphere is considered to be created by the solar wind. The magnetosphere resonates differently depending on the solar wind pressure, speed, and other factors creating the frictional force on the magnetopause. Satellite data in agreement with the theory are discussed. N.E.N.

N71-32528# Minnesota Univ., Minneapolis. Particle Technology Lab.
AEROSOL MEASUREMENTS IN LOS ANGELES SMOG.

VOLUME 1
K. T. Whitby Feb. 1971 153 p refs
(Grant AP-00839)
(PB-198816; APTD-0630) Avail: NTIS CSCL 13B

A collaborative research study on the physical and chemical properties of Los Angeles smog aerosol was undertaken by a group of investigators. The experiments were divided into the following main categories: (1) Measurement of the number versus size spectra measurements using the automated Minnesota Aerosol Analyzing System. (2) Sampling of the aerosol by lundgren impactor for mass and chemical composition versus size distribution. (3) Continuous gas analyzers. (4) Turbidimetric measurements. (5) Miscellaneous experiments including: cloud condensation and ice nuclei, samples for electron microscope and single particle chemical analysis, humidity effects, smog making in a bag, smog coagulation in a bag and particle beam experiments. GRA

N71-32601# American Inst. of Crop Ecology, Silver Spring, Md.
AICE SURVEY OF USSR AIR POLLUTION LITERATURE. VOLUME 6: AIR POLLUTION IN RELATION TO CERTAIN ATMOSPHERIC AND METEOROLOGICAL CONDITIONS AND SOME OF THE METHODS EMPLOYED IN THE SURVEY AND ANALYSIS OF AIR POLLUTANTS
M. Y. Nuttonson 1971 136 p refs
(Contract AP-00786)
(PB-198527; APTD-0653) Avail: NTIS CSCL 13B

The survey includes the following: propagation of atmospheric impurities under urban conditions; dangerous conditions of pollution of the atmosphere by industrial discharges; theory of the dependence between the concentration of aerosols in the atmosphere and their flow onto a horizontal board; meteorological observations in the study of industrial pollution of the ground layer of air; thermal stability in the ground layer of air; atmospheric pollution in cities; methods of operating atmospheric pollution observation posts; statistical methods for observational data on air pollution; and statistical analysis of data on air pollution in cities by means of natural functions. GRA

N71-32611*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SURFACE REFRACTIVITY MEASUREMENTS AT NASA SPACECRAFT TRACKING SITES
P. E. Schmid May 1971 56 p refs
(NASA-TM-X-65647; X-551-71-176) Avail: NTIS CSCL 03B

The results are summarized of a worldwide surface refractivity test conducted in 1968 in support of the Apollo program. The results are directly applicable to all NASA radio tracking systems. Author

N71-32629# Army Foreign Science and Technology Center, Charlottesville, Va.
STANDARDIZATION OF REQUIREMENTS FOR PROGRAMS OF ANALYTICAL SPATIAL PHOTOTRIANGULATION [O STANDARTIZATSII TREBOVANII K PROGRAMMAM ANALITICHESKOI PROSTRANSTRENNOI FOTOTRIANGULYATSII]
V. A. Polyakova 18 Mar. 1971 10 p Transl. into ENGLISH from Geod. Kartografiya (USSR), no. 12, 1969 p 3–6
(AD-723426; FSTC-HT-23-161-71) Avail: NTIS CSCL 8/2

There are several variants of programs for the analytical method of constructing spatial phototriangulation networks. It can be predicted that in the future there will be several quite different solutions of this problem, each of them being suitable for specific combinations of conditions. In this article, the author has endeavored to formulate some of the requirements on standardization of such programs which in his opinion are the final requirements on basis for discussion. It is his opinion that the final requirements on standardization of programs are required in order to bring greater order and efficiency into the use of analytical methods of spatial triangulation and topographic and geodetic work. Author (GRA)

N71-32636# Oregon State Univ., Corvallis. Dept. of Civil Engineering.
AERIAL PHOTOGRAPHIC TRACING OF PULP MILL EFFLUENT IN MARINE WATERS
Fred J. Burgess and Wesley P. James Aug. 1970 160 p refs
(Grant FWQA-WP-00524)
(PB-198232; W71-06258) Avail: SOD $1.25; NTIS CSCL 13B

Aerial photography taken of waste plumes from Kraft pulp mill ocean outfalls was shown to be an effective tool in the study of waste disposal sites. This technique is not limited by sea conditions and permits monitoring and evaluation of outfall sites throughout the year. Photography taken at one instant provides comprehensive information throughout the waste field. Manpower requirements and costs for this method are considerably less than for conventional boat sampling surveys. Field studies were conducted on the waste plumes from Kraft pulp mill ocean outfalls at Newport and Gardiner, Oregon and Samoa, California. Waste concentrations were measured by conventional boat sampling techniques while aerial photography was taken of the outfall area from altitudes ranging from 3,000 to 11,000 ft. Computerized procedures were used to compute water currents, waste concentrations, toxicity zones and diffusion coefficients from the photography. The maximum concentration determined over the outfall for each field study was generally less than that shown to have a detrimental effect on young salmon for a 14-day exposure. Surface water current was to be the dominant factor in the resulting plume pattern. During periods of low current velocities in the receiving water, the hydraulic head created by the effluent source was a significant factor in the resulting plume shape. Author

N71-32646# National Science Foundation, Washington, D.C.
SELECTED ARTICLES FROM ACTA GEOPHYSICA POLONICA
1970 24 p refs Transl. into ENGLISH from Acta Geophysica Polonica (Stockholm), v. 17, no. 2, 1969
(TT-70-55086) Avail: NTIS

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1. CONTRIBUTION TO THE PROBLEM OF SECULAR VARIATION ANOMALY E. Kalinowska-Widomska et al p 1–10 refs (See N71-32647 19-13)

2. GEOMAGNETIC FIELD IN SOUTHERN POLAND DURING THE LAST MILLENIUM J. Kruczyk et al p 11–24 refs (See N71-32648 19-13)

N71-32647# National Science Foundation, Washington, D.C.
CONTRIBUTION TO THE PROBLEM OF SECULAR VARIATION ANOMALY [CONTRIBUTION AU PROBLEME DE L ANOMALIE DES VARIATIONS SECULAIRES]
E. Kalinowska-Widomska et al *In its* Selected Articles from Acta Geophysica Polon. 1970 p 1–10 refs (See N71-32646 19-13)
Avail: NTIS

The question of whether the phenomenon of secular variations anomaly occurs in the area of the Warsaw anomaly, of which the first map was drawn in 1937/38, is studied. The field measurements of the components H and Z were repeated in 168 points of the old network, in the course of 1964 to 1966. A strict comparison between the two surveys of the Warsaw anomaly (for 1937/38 and 1964/66) establishes an obvious deformation of that anomaly in the course of 28 years. Based on the spatial distribution of the values Delta Delta H and Delta Delta Z, the area where the (relative) positive and negative anomalies of the two components were registered was delimited. Besides, it could be observed that

during this period the anomaly of H component had slightly increased, while that of component Z underwent a small reduction. The anomaly of secular variations for the H component is much more pronounced than that for component Z which would suggest that its source lies at a comparatively slight depth. Author

N71-32648# National Science Foundation, Washington, D.C.
GEOMAGNETIC FIELD IN SOUTHERN POLAND DURING THE LAST MILLENIUM [POLE GEOMAGNETYCZNE NA TERYTORIUM POLSKI POLUDNOWEJ W CZASIE OSTATNIEGO TYSIACLECIA]
J. Kruczyk et al *In its* Selected Articles from ACTA Geophysica Polon. 1970 p 11–24 refs (See N71-32646 19-13)
Avail: NTIS

The collection of archeomagnetic specimens from several archeological ruins dating from the early 13th century is described, and the results of magnetic intensity and inclination measurements are discussed. The absolute values of the field intensity substantiate the planetary character of the variation of the terrestrial magnetic moment. In particular, the data from the Polish specimens were compared with similar data from Ukraninian specimens of the same geographic latitude and differing by 10.5 deg in longitude. The comparison supports the theory of a westward drift, indicating a drift velocity of 0.12 deg + or − 0.06 deg/year. Comparisons of measurements of potters settlements in the Cracow province with 4th century data from the Ukrane also corroborate the main regularities of the drift theory. N.E.N.

N71-32681# Radiation Research Associates, Inc., Fort Worth, Tex.
COMPUTER PROCEDURES FOR CALCULATING TIME DEPENDENT LIGHT SCATTERING IN SPHERICAL-SHELL ATMOSPHERES Final Report, 1 Jul. 1968–31 Jan. 1971
Dave G. Collins and Michael B. Wells Apr. 1971 141 p refs (Contract DASA01-68-C-0169)
(AD-722713; RRA-T7017; DASA-2640) Avail: NTIS CSCL 4/1

The report describes three Monte Carlo procedures that were developed for the purpose of providing calculational tools that could be used to study the transport of visible and infrared light in spherical-shell atmosphere. These procedures, designated as FLASH, treat atmospheric scattering problems for plane-parallel, point, volume and spherical surface sources. The FLASH procedures consider the effect of Rayleigh and aerosol scattering and ozone, water vapor, CO2, and aerosol particle absorption on the transport of light. The procedures also consider the changes in polarization that occurs at each scattering event. The input formats of the codes allows one to describe the scattering and absorption properties of the atmosphere as a function of altitude. Provisions are incorporated for treating the reflection of light from ground and cloud surfaces with an albedo method. Also described are the MIE-II and SHINE procedures. The MIE-II procedure uses Mie theory to generate aerosol particle scattering and absorption coefficients and the four elements of the aerosol phase matrix for use as input data to the FLASH procedures. The SHINE procedure was developed to integrate the results of FLASH calculations for point monochromatic sources over an arbitrary wavelength, and time dependent source spectrum. Author (GRA)

N71-32729# Bureau of Mines, Spokane, Wash. Mining Research Lab.
PRELIMINARY SURVEY OF POLYMER IMPREGNATED ROCK
Lester J. Crow, Dennis J. Kelsh, Meyer Steinberg (Brookhaven Natl. Lab.) and Peter Colombo (Brookhaven Natl. Lab.) Jul. 1971 39 p refs
(BM-RI-7542) Avail: NTIS

Increases in compressive strengths by factors of 2 to 5, and elastic moduli by factors of 2 to 3.5, are reported for natural rocks (tuff, sandstone, dacite), which were impregnated with five monomers (methyl methacrylate; chlorostyrene; 40 percent TMPTMA-60 percent styrene; 40 percent TMPTMA-60 percent chlorostyrene; 60 percent polyester-40 percent styrene); polymerization took place after monomers were forced into the rock. Impregnation was performed by pressurizing rock specimens from one end, or by a vacuum-soak operation. Polymerization was accomplished by either radiation or chemical initiation techniques. Strength improvement was dependent on the type of monomer used, the amount of polymer incorporated into the rock, and the degree of water saturation of the rock. Water saturation strongly reduced the effectiveness of the method for the polymer systems tested. The more viscous monomers were more effective in displacing the water from the rock, and compressive strengths of wet rock were doubled with these systems. Water saturations ranging from 25 to 100 percent of maximum saturation gave essentially identical results. Author

N71-32753*# Environmental Science Services Administration, Rockville, Md.
BOMEX PARTICIPANTS INFORMATION EXCHANGE
In its BOMEX Bull., No. 6 Mar. 1970 p 42–60 (See N71-32751 19-34)
Avail: NTIS CSCL 08C

Summaries of the status and progress of BOMEX experiments are reported. Included are the names of the principal investigators, and references to related reports or papers. F.O.S.

N71-32784# Academy of Sciences (USSR), Moscow. Inst. for Space Research.
THE UPPER ATMOSPHERE DENSITY DETERMINATION FROM THE COSMOS SATELLITE DECELERATION RESULTS
P. E. Eliasberg, B. V. Kugaenko, V. M. Synitsin, and M. I. Voiskovski 1971 16 p refs
(D-80) Avail: NTIS

Cosmos satellite deceleration measurements present a vast amount of material for studying the structure of the upper atmosphere, especially at altitudes of from 160 to 300 km. For these altitudes they can be used for checking and refining standard atmospheric models. The results from 1964 through 1970 are given, and a simple analytic relationship is defined for determining the upper atmosphere density, allowing for its main variations. ESRO

N71-32786*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A THREE DIMENSIONAL MODEL OF THERMOSPHERIC DYNAMICS. 2: TIDAL WAVES
H. Volland (Bonn Univ., West Ger.) and H. G. Mayr Jun. 1971 58 p refs Submitted for publication
(NASA-TM-X-65658; X-621-71-241) Avail: NTIS CSCL 04A

The generation and the propagation of three fundamental tidal modes - the symmetric diurnal mode, the symmetric semidiurnal mode and the antisymmetric diurnal mode - were studied. The equivalent depths of these modes and the eigenfunctions which describe the latitudinal structure in the pressure field are shown to change with altitude. While within the lower atmosphere the eigenfunctions are the Hough-function they transfer into the ordinary spherical functions at thermospheric heights. The transition occurs between 100 and 200 km. Horizontal winds and pressure amplitudes of the three modes which depend on altitude and latitude are determined and compared with available wind and density data. Author

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N71-31605*# Aerospace Corp., El Segundo, Calif.
REAL TIME DIGITAL VIDEOMAGNETOGRAPH AT THE AEROSPACE SAN FERNANDO SOLAR OBSERVATORY
1971 46 p
(Contract NAS9-8388)
(NASA-CR-115113) Avail: NTIS CSCL 14B

The design criteria for developing the digital video magnetograph are presented. The requirements considered include: factors which determine the performance figure, scanning mode, image sensor, storage, and processing. The principles of operation, and the equipment are described. F.O.S.

N71-31649# Ion Physics Corp., Burlington, Mass.
LODIF: AN IR SURVEILLANCE CAMERA
Edward D. Spear *In* Kentucky Univ. Proc. of 1970 Carnahan Conf. on Electron. Crime Countermeas. Apr. 1970 p 207–230
(See N71-31628 19-10)
Avail: NTIS

An infrared camera with a searchlight and flash lamp for obtaining photographic documentation in total darkness is described. Operating on its own internal batteries, the camera/flash combination provides pictures of sufficient quality to identify faces at a maximum range of 400 feet. Author

N71-31719# TRW Systems Group, Redondo Beach, Calif. Applied Mechanics Lab.
NONDESTRUCTIVE TESTING USING TRW ACOUSTO-OPTICAL IMAGING SYSTEM Semiannual Report, 30 Jun. – 30 Dec. 1970
Robert Aprahamian, Jerold L. Jacoby, Pravin G. Bhuta Jan. 1971 30 p refs
(Contract DAAG46-70-C-0103; ARPA Order 1245)
(AD-723434; AMMRC-CR-71-4/1) Avail: NTIS CSCL 14/2

The technique of Acousto-Optical Imaging (AOI) enables one to see, on a real-time basis, within optically opaque materials and to detect internal or surface flaws and/or other irregularities which might be present. The process uses an ultrasonic beam to probe the object under study. As it interacts with the object, the ultrasonic beam acquires an acoustical picture of the object. The acoustic waves then interact with a monochromatic light beam (as from a laser). Optical sidebands are produced by the Bragg diffraction of light. The cumulative result of this process is that these sidebands produce a visual image of the interior of the object. This paper discusses the results of an experimental study to evaluate the applicability of acousto-optical imaging to nondestructive testing. In addition to the determination of the system resolution, the effects of specimen thickness, geometry, composition and surface roughness are under investigation. A new technique which utilizes the sound reflected from the specimen to obtain an acousto-optical image was also developed. Preliminary results utilizing this technique to detect surface flaws on a specimen are encouraging. Author (GRA)

N71-31723# Dynasciences Corp., Blue Bell, Pa. Scientific Systems Div.
HELICOPTER PAYLOAD CAPABILITY INDICATOR Final Report, May 1968 – Nov. 1969
E. Kisielowski and E. Fraundorf Aberdeen Proving Ground, Md. Army Land Warfare Lab. Mar. 1971 64 p refs
(Contract DAAD05-68-C-0366)
(AD-723436; LWL-CR-02M69) Avail: NTIS CSCL 14/2

A feasibility study was made of a helicopter payload meter concept. A simple, manually operated device was developed and tested, which gives an indication of payload capability in terms of gas generator speed for the prevailing atmospheric conditions where vertical take-offs and landings are required from a confined area. Tests were conducted by the U.S. Army Aviation Test Board, and the device was found to have military potential. Author (GRA)

N71-31727# Naval Air Development Center, Johnsville, Pa. Aero Mechanics Dept.
STRUCTURAL ANALYSIS OF THE LASER CAMERA MODULE AND ITS INSTALLATION FOR THE LASER AIRBORNE PHOTOGRAPHIC SCANNING SYSTEM (LAPSS) ON THE RA-5C AIRCRAFT Final Report
Carl H. Acker 12 Feb. 1971 76 p refs
(AD-723820; NADC-AM-7031) Avail: NTIS CSCL 14/5

The report presents a structural analysis of the Laser Camera Module and its installation for the LAPSS (Laser Airborne Photographic Scanning System) on the RA-5C Aircraft. This analysis serves as substantiation for the structural integrity of the module and its installation for all normal flight and carrier operational conditions for the RA-5C Aircraft. Author (GRA)

N71-31732# Virginia Univ., Charlottesville.
THE APPLICATION OF IMAGE SENSING ARRAYS TO METROLOGY, DETECTION AND INSTRUMENTATION Final Report
Eugene S. McVey, Edward A. Parrish, Jr., and Gerald Cook May 1971 53 p refs
(Contract DAAK02-70-C-0280)
(AD-723422; EE-3389-104-71U; ETL-CR-71-6) Avail: NTIS CSCL 14/2

The report covers one year of research on what is intended to be a relatively long-term effort devoted to the study of the application of image sensing arrays and related problems. A major portion of the effort has been to further the understanding of applying perturbation to improve performance of sensor arrays. Future work will continue to be concerned with the fundamentals of making precise optical type measurements and delineating the limits of this technology. Author (GRA)

N71-31838*# Ohio State Univ., Columbus. Dept. of Geodetic Science.
EXPERIMENTS WITH WILD BC-4 PHOTOGRAPHIC PLATES
Charles R. Schwarz, Ivan I. Mueller, James P. Veach, and Daniel H. Hornberger *In* NASA. Goddard Space Flight Center Proc. of the GEOS-4 Program Rev. Meeting, Vol. 1 Nov. 1970 p 297–328 refs (See N71-31826 19-13)
(Grant NGR-36-008-093)
Avail: NTIS HC$6.00/MF$0.95 CSCL 14E

The photogrammetric method and the astronomical method of plate reduction were investigated using plates taken by the Wild BC-4 camera to determine what kind of systematic effects should be removed, or how large a portion of the plate can be reduced without a priori corrections. Plates showing the residuals using both methods are presented. It is concluded that the astrometric method can be satisfactorily used to reduce small areas of the plate around the satellite image. F.O.S.

N71-31839*# Ohio State Univ., Columbus. Dept. of Geodetic Science.
EXPERIMENTS WITH THE USE OF ORBITAL CONSTRAINTS IN THE CASE OF SATELLITE TRAILS ON WILD BC-4 PHOTOGRAPHIC PLATES

Charles R. Schwarz *In* NASA. Goddard Space Flight Center Proc. of the GEOS-2 Program Rev. Meeting, Vol. 1 Nov. 1970 p 329–346 refs (See N71-31826 19-13)
(Grant NGR-36-008-093)
Avail: NTIS HC$6.00/MF$0.95 CSCL 14E

The feasibility of adjusting satellite directions determined from BC-4 photographic plates in the short arc orbital mode was studied, and the solution obtained in the orbital mode was compared with the corresponding geometric mode solution. It is concluded that when using right ascensions and declinations as the basic data the best results are obtained either by using three to five fictitious images, obtained from three to five separate curve fits, or by using 10 individual images in the geometric mode. The use of 20 images from each plate is not justified due to the worsening of the solution caused by correlation between observations. F.O.S.

N71-31854*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE JUPITER CAMERA INTERCOMPARISON TEST
Frank G. Rawlinson, David W. Harris, John H. Berbert, and John D. Oosterhout *In its* Proc. of the GEOS-2 Program Rev. Meeting, Vol. 2 Nov. 1970 p 217–222 (See N71-31843 19-13)
Avail: NTIS CSCL 14E

An intercomparison test of various cameras used in the photographic tracking of GEOS-1 is described. Simultaneous photographs of GEOS-1 were taken with the cameras placed within 30 m of each other to minimize ground parallax. Test results for the SAO Baker-Nunn, SAO K50, PC-1000, MOTS-40, PTH-100, MOTS-24, and BC4 cameras are tabulated. J.M.

N71-31855*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GEOS-1 AND GEOS-2 MOTS CAMERA OPERATIONS, DATA ANALYSIS AND EXPERIMENTS
David W. Harris *In its* Proc. of the GEOS-2 Program Rev. Meeting, Vol. 2 Nov. 1970 p 223–226 (See N71-31843 19-13)
Avail: NTIS CSCL 14E

Photographic tracking operations with MOTS cameras using the GEOS 1 and 2 satellites are summarized. Data analysis and validation procedures are discussed as well as the camera sensitivity and accuracy. The camera-drive system performance is also evaluated. J.M.

N71-31859*# Smithsonian Astrophysical Observatory Cambridge, Mass.
A PHOTOGRAPHIC TECHNIQUE FOR IMPROVED LASER-RANGING ACCURACY
C. G. Lehr, M. R. Pearlman, and J. L. Scott *In* NASA. Goddard Space Flight Center Proc. of the GEOS-2 Program Rev. Meeting, Vol. 3 Nov. 1970 p 51–66 refs (See N71-31856 19-13)
(Grant NGR-09-015-002)
Avail: NTIS CSCL 14E

The instrumental errors of the ruby laser systems of Smithsonian Astrophysical Observatory can be reduced from 1 to 2 m to 20 to 50 cm by applying corrections to the readings of the time-interval counters. These corrections are obtained from oscilloscope photographs of the return pulses. The correction is the time between the intersection of the counter's stop threshold and the centroid of the pulse. The accuracy of the correction depends on how well the threshold and the centroid can be located on the photograph. It also depends on the accuracy with which the system's electrical delay can be measured. The statistical procedures that were used for accurate determinations of the threshold, the centroid, and the delay are described. Author

N71-31873*# Geodetic Survey Squadron (1st), F. E. Warren AFB, Wyo.
DATA ACQUISITION WITH THE PC-1000 CAMERA SYSTEM
N. R. Goff *In* NASA. Goddard Space Flight Center Proc. of the GEOS-2 Program Rev. Meeting, Vol. 4 Nov. 1970 p 97–106 (See N71-31867 19-13)
Avail: NTIS CSCL 14E

The development of optical satellite triangulation camera systems grew out of work with ballistic cameras which were used to study missile trajectories during the 1950's. The basic theory is to use satellites photographed against a star background, for geodetic positioning. The first PC-1000 camera system had the electronic camera control and timing equipment housed in a van and the camera installed some distance away. The second generation system provided improved time keeping. The next improved system contained an internal shopping shutter to allow for faster data collection. Comparison studies of lens distortion values over long periods showed that the PC-1000 is very stable. Author

N71-31878*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ALTIMETER BIAS RECOVERY FROM RANGE AND ANGLE OBSERVATIONS
J. Berbert and F. Loveless (DBA Systems, Inc., Lanham, Md.) *In its* Proc. of the GEOS-2 Program Rev. Meeting, Vol. 4 Nov. 1970 p 241–252 refs (See N71-31867 19-13)
Avail: NTIS CSCL 14B

The overall system accuracy sought for the GEOS-C altimeter system has been established at 5 meters. This figure includes the error contributions from several sources. The known system error sources and estimates of their nominal magnitudes are found for; (1) altimeter instrumentation; (2) refraction; (3) reflection from waves; and (4) spacecraft attitude (non-nadir reflection). Author

N71-31929# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung Heterogene Stroemungen.
DEVELOPMENT OF A HEAT FLOWMETER FOR TEMPERATURES FROM 100 TO 300 C AND HEAT FLUXES FROM 1000 TO 10,000 kcal/sq m h AND ITS CALIBRATION [DIE ENTWICKLUNG EINES WAERMESTROMMESSERS FUER TEMPERATUREN VON 100 BIS 300 C BEI WAERMESTROEMEN VON 1000 BIS 10000 kcal/m2 h UND SEINE EICHUNG]
Fritz Eisfeld, Klaus Pientka, Klaus-Juergen Schultz, and Wolf Splettstoesser Jan. 1971 33 p refs In GERMAN; ENGLISH summary
(DLR-MITT-71-07) Avail: NTIS; DFVLR Porz: 9,50 DM

The development and construction of a heat flowmeter for temperatures up to 300 C and a heat flux density up to 10,000 kcal/sq m.h are described. The design of an adequate calibration device as well as the performance of the calibration are presented, and the experience resulting from the first tests with the heat flowmeter, is communicated. The heat flow meter is to be applied to heat dissipation measurements of the insulation of an energy transportation system for hot exhaust gases of VTOL projects. Author (ESRO)

N71-31930# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
HIGH RESOLUTION 7–16 MICRON INFRARED SPECTROMETRY [SPECTROMETRIE INFRAROUGE A HAUTE RESOLUTION DE 7 A 16 MICRON]
Jean Botineau (Ph.D. Thesis–Paris Univ.) 1971 60 p refs In FRENCH; ENGLISH summary
(ONERA-NT-176) Avail: NTIS

Alterations have been made on a grilles' spectrometer in order to extend its use to gas molecular spectroscopy. This spectrometer has been equipped with a precise calibration device: a source of known spectral composition supplies the reference points to the spectrum under study; an accurate interpolation

between these points is made possible by using an interferometric device. A rational adaptation of cooled quantum detectors has also been studied; a liquid helium cryostat of a new type has been designed in view of using in the best conditions a copper-doped germanium sensor. A complete atlas of the methane nu sub 4 band, around 1300/cm, has been established; the fine structure of the three P, Q, and R branches is evidenced in the spectra obtained. Lastly, a study aiming at making more objective and more accurate the numerical data reduction has been undertaken. Author (ESRO)

N71-31968# Australian National Univ., Canberra. Research School of Physical Sciences.
NOTES ON NUCLEAR SPECTROSCOPY INSTRUMENTATION
T. R. Ophel [1970] 39 p refs
(ANU-P-502) Avail: AEC Depository Libraries

A summary is given of equipment that has been developed for spectroscopy measurements. Illustrations and descriptions are provided for 50 cm dia scattering chambers, general purpose gamma ray and neutron scattering chambers, D-shaped chambers, target holders, ladders, preparation and use of unstable target materials, cold traps, counter coolers, target modulation techniques, sodium iodide detector mounts and shielding, accelerator calibration, a detector test chamber, and collimators. A list is given of available radioactive sources and a discussion on background in semiconductor detectors and contaminants in gamma ray spectra is appended. NSA

N71-31974# Istituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica.
PHASE-SENSITIVITY MICROWAVE SPECTROMETER FOR SUPERCONDUCTIVE TRANSITIONS [UNO SPETTROMETRO A MICROONDE PER LA RIVELAZIONE A SENSIBILITA DI FASE DI TRANSIZIONI SUPERCONDUTTIVE]
M. Flamini, P. L. Indovina, and A. Rosati 2 Mar. 1970 32 p refs In ITALIAN
(ISS-70/5) Avail: AEC Depository Libraries

A measurement method is described to detect superconductive transitions as a function of the magnetic field applied by means of a phase-sensitivity technique. A detailed description of the modulation parameters is given, according to the criteria followed in EPR experiments. In description of the experimental equipment, particular attention is given to the stabilization system of the microwave generator and to the detection method. Furthermore the resonant cavity associated to the cryogenic system is fully explained. Author (NSA)

N71-32021# Naval Training Device Center, Orlando, Fla.
THE ANALYSIS AND ENGINEERING DESIGN OF A PINHOLE TV CAMERA Technical Report, 1965–1969
Robert J. Klaiber and John C. McKechnie Jun. 1970 67 p refs
(AD-723182; NAVTRADEVCEN-IH-145) Avail: NTIS CSCL 17/2

Pinholes used in place of glass lenses in combination with modern high grain low noise level TV camera tubes may solve some television visual display problems. Both increased depth of field and field of view are logically anticipated results. The high f-number of a pinhole might be compensated for by the high signal gain of currently available TV camera tubes. Analytical results indicate that a 100 degrees wide included field of view can be attained with moderate lighting levels and available hardware. It is recommended that a TV pinhole camera system be constructed of stated design requirements for further testing and evaluation. Author (GRA)

N71-32084# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
NEUTRON MEASUREMENT DEVICE WITH A WIDE DYNAMIC RANGE, WITH COMBINATION OF PULSE AND FLUCTUATION TECHNIQUES [ENSEMBLE DE MESURE NEUTRONIQUE A GRANDE DYNAMIQUE COMBINAISON IMPULSION FLUCTUATION]
Y. Plaige, J. Buisson, J. Garau, and J. Lyscar 12 Feb. 1971 19 p In FRENCH
(CEA-N-1425) Avail: AEC Depository Libraries

Pulse instrumentation is now widely used in reactor control. Fluctuation instrumentation is currently being industrially developed. Both types of instrumentation use the same detectors, that is fission chambers. In consequence an instrument with a wide dynamic range adapted to both techniques was studied. A theoretical analysis of the problem is presented and the practical developments and results obtained from tests with a pile discussed. It seems possible that in the near future a control instrumentation functioning over 10 decades will be available. Author (NSA)

N71-32132# Aerojet-General Corp., El Monte, Calif.
DEVELOPMENT OF A CALIBRATION MODULE FOR TRACE OXYGEN ANALYZERS
H. C. Edgington and R. M. Roberts Dec. 1970 150 p refs
(Contract DI-14-01-0001-2127)
(PB-198640) Avail: NTIS SOD $1.25 CSCL 14B

The work that was carried out in the design, fabrication and testing of a dissolved oxygen calibrator is described. The calibration module achieves deoxygenation in a two stage spinning disc stripper by flowing feedwater and oxygen-free nitrogen gas countercurrently. Oxygen is added by coulometric generation into the second stage nitrogen purge gas. This instrument gives dissolved oxygen (D.O.) contents of 0 to 100 ppb which are accurate to within plus or minus 2 ppb. In asmuch as existing methods for D. O. analyses were of undetermined accuracy, a parallel research was conducted which resulted in the development of an Aerojet modified Winkler procedure. Author (GRA)

N71-32136# Kernforschungszentrum, Karlsruhe (West Germany).
PERSONNEL MONITORING WITH RADIOPHOTOLUMINESCENT DOSIMETERS
E. Piesch Nov. 1970 32 p refs
(NP-18746; Rept-20/70-2) Avail: AEC Depository Libraries

A brief introduction is given on the dosimetric properties of silver activated phosphate glass photoluminescent dosimeter systems. Based on the results of calibration test exposures and results of a five year routine dosimetry program, personnel monitoring with glass dosimeters is described. The technical requirements for the dose evaluation (identification of glass, washing of glass, predose, re-use of glass, measuring accuracy and reproducibility); the organization of a measurement service (working procedure, working period, cost); and the application in radiation monitoring (routine and accidental dosimetry, long-time dosimetry, activation dosimetry) are discussed. Also, some possibilities for further improvements are given. Author (NSA)

N71-32165# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF VELOCITY PROFILE DISTORTION IN LONG dc ELECTROMAGNETIC FLOWMETERS
Shee-Ming Chen Washington Aug. 1971 40 p refs
(NASA-TM-X-2342; E-6259) Avail: NTIS CSCL 14B

To make precision liquid metal flow rate measurements using a dc electromagnetic flowmeter it is necessary to consider such effects as the distoration of the velocity profile by the magnetic field and the entry and exit processes at the edges of the magnetic field. The distorted velocity profile and corresponding electric potential distribution are determined using a two-dimensional model in simulation of a long electromagnetic flowmeter. The method of finite differences is used in solving the

magnetohydrodynamic equations for a circular pipe with either a non-conducting or conducting wall. Calibration curves, as well as numerical solutions for the velocity and potential distributions over the pipe cross section, are obtained for various combinations of fluid and wall conductivity, thickness of the pipe wall, and Hartmann number. Author

N71-32238# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Physics Div.
CHARGE TRAPPING IN SEMICONDUCTOR DETECTORS: A THEORETICAL APPROACH
J. M. Blair and T. A. McMath Dec. 1970 25 p refs
(AECL-3786) Avail: AEC Depository Libraries; Atomic Energy of Can., Ltd., Chalk River $0.50

A probability theory approach has been employed to study the effects of the statistical variation in induced charge in a semiconductor detector whose charge collection properties are well characterized by the carrier mean free drift lengths gamma sub e and gamma sub h. It is shown that the resulting spread in pulse amplitude cannot account for the broadening of the full energy peaks observed in detectors which show charge trapping effects. Author (NSA)

N71-32274*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PISTON MANOMETER AS AN ABSOLUTE STANDARD FOR VACUUM-GAUGE CALIBRATION
I. Warshawsky [1971] 17 p refs Proposed for presentation at 5th Intern. Vacuum Congr., Boston, 12–15 Oct. 1971; sponsored by the Am. Vacuum Soc.
(NASA-TM-X-67889) Avail: NTIS CSCL 14B

Total pressure in a calibration volume is determined by measuring the force on a thin circular disk, of accurately known area, that is freely suspended in a hole in the container wall, so that the disk is substantially flush with the wall. The disk almost fills the hole, so that there is a narrow annular gap. A continuous flow of calibrating gas, injected into the container in order to maintain a desired pressure, passes through the annular gap to a diffusion pump. The ratio of pressures on the two faces of the disk is on the order of 100:1, so that downstream pressure need be known only nominally in order to deduce the upstream pressure. Force on the disk is measured by a balance that is calibrated in situ with dead weights. In one arrangement, pressures in the range of 10–500 microtorr were measured with an estimated probable error of (1 microtorr + 1%). Author

N71-32308# Sandia Corp., Albuquerque, N.Mex.
EVALUATION OF THE IMPEDANCE PROBE METHOD OF SHOCK SPEED MEASUREMENT
A. J. Mulac and J. A. Guzman Apr. 1971 15 p refs Sponsored by AEC
(SC-DR-710088) Avail: NTIS

An ionization probe method of shock detection was investigated experimentally. The impedance probe technique includes an electronics package designed to produce well defined timing pulses corresponding to shock arrival at the probes. The performance of this circuit is evaluated. Results indicate that the impedance probe method is useful for moderately strong shock waves in gases which do not exhibit strong precursors. Author

N71-32311# California Univ., Livermore. Lawrence Radiation Lab.
TRIAXIAL BIDIRECTIONAL INTEGRATING 4-LEVEL ACCELERATION AMPLITUDE RECORDER LEA69-3100
Jasper J. Morrison Mar. 1971 8 p Presented at the 17th Ann. Meeting and Equipment Exposition, Los Angeles, 26–30 Apr. 1971 Sponsored by AEC
(UCRL-72748) Avail: NTIS

A transportation shock and vibration monitor is described for recording the measurements of the magnitude, direction, and number of inputs that the acceleration environment was above damage levels in the shipment of complex mechanical equipment. The operation of the recorder is also described. F.O.S.

N71-32313# Argonne National Lab., Ill.
NOTES ON ELECTRON PARAMAGNETIC RESONANCE SPECTROSCOPY
Juan A. McMillan Dec. 1970 112 p refs
(Contract W-31-109-eng-38)
(ANL-7764) Avail: NTIS

The fundamental aspects of electron paramagnetic resonance spectroscopy, with emphasis on the theoretical principles underlying the interpretation of results are reported. A basic knowledge of quantum mechanics and familiarity with group-theoretical arguments was assumed. Some aspects of electromagnetic theory, electron wavefunctions, the theory of angular momentum operators, and tensor algebra were briefly reviewed. The theory of the g tensor and of hyperfine interactions in transition metal ions was treated in detail. Tables of expectation values of hyperfine separations based on recent Hartree–Fock calculations were given in the appendixes. Author

N71-32314# Mound Lab., Miamisburg, Ohio.
STATISTICAL ANALYSIS OF COULTER COUNTER PARTICLE SIZE DATA
C. S. Friedman 26 Mar. 1971 11 p
(Contract AT-33-1-GEN-53)
(MLM-1810) Avail: NTIS

An experiment was designed to study the reliability of Coulter Counter particle size analysis of samples removed from pellets of pressed explosive material. The experiment showed a high degree of sampling reproducibility and the data did not indicate any statistically significant differences between the pellets. Author

N71-32335# Spatial Data Systems, Inc., Goleta, Calif.
A DIGITAL PHOTOGRAPHIC DATA PROCESSOR AND DISPLAY SYSTEM Final Report, 1 Sep. 1970–28 Feb. 1971
Ralph E. Athearn and David F. Rutland 1 Mar. 1971 14 p
(Contract F19628-71-C-0019)
(AD-723657; AFCRL-71-0249) Avail: NTIS CSCL 14/5

A digital picture processing system for extracting information from photographic film records was constructed and delivered. The system uses a Digital Video Converter that permits picture data transfer and display between a Digital Processor and a standard 525 line Television System. The Digital Processor has an 8000 word core memory and a Digital Tape Unit for storage and processing of digitized pictures. The Digital Video Converter stores a complete digital picture consisting of 384 x 489 picture elements on a magnetic disc. The picture elements, each having one of 256 possible shades of grey, are refreshed at standard television rates and are displayed in black and white on a television monitor or analyzed in a color television densitometer display. Television pictures of photographic transparencies are produced from a precision camera, digitized at an 8 MHz sampling rate and recorded on the disc for subsequent analysis by the Data Processor. Software for self-checking the system, transferring picture data and digitizing pictures was supplied with the equipment. Author (GRA)

N71-32343# Union Carbide Corp., Oak Ridge, Tenn.
CAPACITANCE GAGE FOR DIMENSIONAL MEASUREMENT
J. J. Henry 20 Apr. 1971 26 p
(Contract W-7405-eng-26)
(Y-1783) Avail: NTIS

A capacitance distance gage has been designed that has a variable frequency output suitable for high-accuracy, noncontact

dimensional inspection with digital readout or direct computer processing. This gage further provides improved performance for medium to high-resistance materials and can be compensated to provide a low temperature drift. A gage stability of + or − 15 microinches in the measuring range from zero to 60 mils has been realized using a 3/8-inch-diameter sensing probe tip, with a 5 F ambient temperature variation. Author

N71-32386*# Honeywell, Inc., Minneapolis, Minn. Government and Aeronautical Products Div.
DESIGN, FABRICATE, PERFORM TESTS, AND DELIVER CERAMIC ENVELOPES IN SUPPORT OF ELECTROSTATIC GYRO DEVELOPMENT Final Report, 24 Jun. 1970 – 15 Jun. 1971
L. C. Mellum 15 Jun. 1971 57 p
(Contract NAS8-26312)
(NASA-CR-119885; HONEYWELL-21600-FR) Avail: NTIS CSCL 14B

The design, development, and fabrication of an alumina ceramic envelope assembly are reported for the cryogenic electrically-suspended gyroscope (CESG), which is under development for use in the Stanford University relativity experiment. In addition to the ceramic envelope assembly, one set of thin-walled copper tubes was designed and fabricated for use as rotor spinup gas inlet, exhaust, and pressure sensing tabulation. These tubes were cemented into simulated envelope ports, cycled five times to liquid nitrogen temperature, and leak checked in order to verify the integrity of the cemented joint design. An experimental effort of limited scope was also conducted to evaluate sputtered quartz as land material for the flyable CESG envelope which is to be fabricated of quartz. Author

N71-32420# British Iron and Steel Research Association, London (England). Plant Engineering and Energy Div.
ISOTOPE GAUGES: AN ANALYSIS OF SOME ERRORS IN HOT METAL THICKNESS MEASUREMENT
F. X. Macedo and F. Serdynski 19 Feb. 1970 17 p refs
(PB-198369; BISRA-PE/B/42/69) Avail: NTIS CSCL 14B

Some of the factors affecting the accuracy of isotope thickness gages are discussed and a theoretical evaluation of the errors due to steel composition, temperature distribution and statistical variation is presented. Three types of steel are considered, each with nominally the same carbon content. Errors in thickness measurement due to the different steel compositions are evaluated for two isotope sources, americium 241 and cesium 137. The effect of temperature distribution across the depth of metal on the mass attenuating the gamma-rays is also considered and the thickness measurements so evaluated are compared with those determined, assuming a homogeneous stock temperature. The principle of constant absorption is described, as well as some of its limitations where a wide range of measurements is required. Author (GRA)

N71-32422*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EVALUATION OF A CONICAL-RECEIVER RADIOMETER
Arthur E. McNutt Apr. 1971 42 p
(NASA-TM-X-65630; X-322-71-197) Avail: NTIS CSCL 14B

Two versions are described of a cone radiometer (an absolute radio meter based on electrical substitution methods); one for operation in a vacuum, the other enclosed in its own small vacuum chamber, for operation under ambient conditions. A discussion of the theory of operation of the radiometer includes measurements from standard sources and other sources to illustrate the performance of the cone and describes a series of special tests to determine the validity of the radiometer, including errors and uncertainties associated with it. Author

N71-32448*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF VELOCITY PROFILE DISTORTION IN CIRCULAR TRANSVERSE-FIELD ELECTROMAGNETIC FLOWMETERS
Norman C. Wenger Washington Aug. 1971 73 p refs
(NASA-TN-D-6454; E-6142) Avail: NTIS CSCL 14B

The theory of circular transverse-field electromagentic flowmeters is extended to include the effect of distortion from axial symmetry in the fluid velocity profile. A general formulation is developed for computing the flowmeter sensitivity for any given velocity profile. It is shown how to best select the flowmeter pipe wall thickness and electrical conductivity to minimize error in the flow measurement due to uncertainties in the velocity profile. The fully developed velocity profile and corresponding flowmeter sensitivity are then computed for a Hartmann number range from 1 to 1000. Numerical results are presented in tabular form for a range of flowmeter parameters that is normally found in liquid metal applications. These results enable the experimenter to correct flow measurements for the effect of velocity profile distortion produced by the flowmeter itself. Author

N71-32476*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE MARK 6 TORQUEMETER, AN INSTRUMENT FOR MEASURING MAGNETIC TORQUES ON SPACECRAFT
J. C. Boyle Washington Aug. 1971 19 p refs
(NASA-TN-D-6387; G-1020) Avail: NTIS CSCL 14B

The Mark VI torquemeter is a lightweight, high-capacity instrument for measuring magnetic torques on spacecraft that weigh up to 3500 N (800 lb). Characteristics, construction, and circuitry of the torquemeter are described. Calibration of the instrument is performed either with precision weights or by means of a known torque that is generated by energizing an air-core coil in the controlled facility field. The instrument has also been used for measuring nonmagnetic torques. Techniques used in calibration and in data acquisition are described in detail. Under favorable circumstances, torques as small as 5 dyne-cm have been measured. Author

N71-32481# National Bureau of Standards, Washington, D.C. Measurement Engineering Div.
A TECHNIQUE FOR MEASURING THE SURFACE TEMPERATURE OF TRANSISTORS BY MEANS OF FLUORESCENT PHOSPHOR Final Report, 1967 – 1969
David J. Brenner Jul. 1971 50 p refs
(NBS-TN-591) Avail: SOD $0.50

A technique that uses temperature-sensitive phosphor to make quantitative measurements of transitor-chip surface temperatures over the range of 170 to 210 C is described. The experimental procedure consisted of depositing a thin coating of phosphor on uncapped power transistors, and then photographing the visible fluorescence generated under near-ultraviolet (UV) excitation. The cooler regions produced a brighter fluorescence than the hotter areas. The surface temperatures of operating transistors were determined by comparing, on a point-by-point basis, the photographic density of operating photographs to the density of a family of calibration photographs. Repeated temperature measurements always fell within a 4 C overall error range when the phospor surface was scanned with a 25 × 25 micrometer aperture. The error band dropped to less than 2 C when a 50 × 50 micrometer aperture was used. Coarseness of the phosphor coating seemed to limit spacial resolution to about 20 micrometers. Author

N71-32523 National Lending Library for Science and Technology, Boston Spa (England).
THE BEHAVIOR OF CHROMEL-ALUMEL THERMO-COUPLES IN TEMPERATURE MEASUREMENTS

S. Garribba et al 30 Sep. 1969 33 p refs Transl. into ENGLISH from Italian report CESNEF-IN-001
(NLL-Risley-Trans-1943-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 8 NLL photocopy coupons

To determine with certainty the performance of chromel-alumel thermocouples in long duration tests below 1000 C, the causes and mechanisms of transformation were systematically investigated. The available data were divided into three parts: homogeneities and variations with time over short periods, variations with time over long periods, and the significance and accuracy associated with calibration. J.G.M.

N71-32553*# Techtran Corp., Glen Burnie, Md.
MATHEMATICAL BASES OF OBLIQUE AND VERTICAL COSMOGRAPHIC PERSPECTIVES [MATHEMATISCHE GRUNDLAGEN SCHRAEGER UND SENKRECHTER KOSMOGRAPHISCHER PERSPEKTIVEN]
Victor Dumitrescu Washington NASA Aug. 1971 16 p refs Transl. into ENGLISH from Rumanian report
(Contract NASw-2037)
(NASA-TT-F-13761) Avail: NTIS CSCL 08B

The mathematical structure of vertical and oblique cosmographic perspectives involving the problem of polar variants, so important for cartographic projections in space, is presented. The first practical testing of the procedure was accomplished and is presented with attention to the initial consideration of the procedure as well as universal and special cases of cosmographic perspectives. Author

N71-32591# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THERMAL FLOW METERS
P. A. Korotkov et al 27 Jan. 1971 200 p refs Transl. into ENGLISH from Mono. Teplovye Raskhodomery (USSR), 1969 p 1–175
(AD-723540; FTD-HC-23-192-70) Avail: NTIS CSCL 14/2

The book describes the principles of operation, circuits and construction of Soviet as well as foreign thermal flow rate meters. The material is arranged according to type, for thermal flow rate meters designed to measure flow rate of liquids, liquid metals and gases. The problems of theory and design of the flow rate meter are discussed. Author (GRA)

N71-32693# Army Foreign Science and Technology Center, Charlottesville, Va.
EXPERIENCE IN OFFICE INTERPRETATION WITH THE INTERPRETOSCOPE [OPYT KAMERALNOGO DESHIFRIROVANIYA S ISPOL'ZOVANIEM INTERPRETOSKOPA]
T. V. Vereshchaka 18 Mar. 1971 12 p refs Transl. into ENGLISH from Geodeziya i Kartografiya (USSR), no. 12, 1969 p 47–52
(AD-723432; FSTC-HT-23-164-71) Avail: NTIS CSCL 14/5

The use of the interpretoscope for office interpretation of aerial photographs makes possible an improvement in the process in general and an improvement in map quality. It is most convenient to employ contact prints as the information source. The experiment described in this paper indicated that in the topographic interpretation of photographs at 1:50,000 for compiling a map at 1:25,000 many features are shown incorrectly (completely or partially); this is an undesirable feature. When aerial photographs at larger scales are interpreted, the interpretoscope gives a considerable effect. Author (GRA)

N71-32605# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON INSTALLATION OF MANOMETER APPARATUS ON AN ORIENTED SATELLITE
V. A. Shabokhin et al 1971 2 p refs Transl. into ENGLISH from Kosmich. Issled. (USSR), v. 9, no. 1, 1971 p 151–152
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The advantages of mounting manometers and mass spectrometers in the nose cone of oriented artificial earth satellites are summarized. Expressions are given for calculating the number of particles passing through a unit area of the instrumentation orifice per unit time. Measurement errors due to angle of attack changes of the Cosmos-320 satellite are discussed. J.M.

N71-32701*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SAS-B DIGITIZED SPARK CHAMBER GAMMA RAY TELESCOPE
S. M. Derdeyn, C. H. Ehrmann, C. E. Fichtel, D. A. Kniffen, and R. W. Ross Aug. 1971 24 p refs Submitted for publication
(NASA-TM-X-65854; X-662-71-304) Avail: NTIS CSCL 14B

The SAS-B gamma ray telescope represents the first satellite version of a planned evolution of gamma ray digitized spark chamber telescopes. The heart of the telescope is a multilayer digitized spark chamber which can clearly establish a gamma ray event and reject events which, in other simpler instruments, might be indistinguishable from ones formed by gamma rays. The telescope is aimed at the study of gamma rays whose energy exceeds about 20 MeV. Author

N71-32748# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
AN EVALUATION OF POSITIVE DISPLACEMENT CRYOGENIC VOLUMETRIC FLOWMETERS
J. A. Brennan, J. W. Dean, D. B. Mann, and C. H. Kneebone Jul. 1971 128 p refs
(NBS-TN-605) Avail: SOD $1.25

The National Bureau of Standards and the Compressed Gas Association have jointly sponsored a research program on cryogenic flow measurement. The operation and the accuracy of the flow facility is briefly described. The performance of the flowmeters on liquid nitrogen is described by reporting the precision and bias of the meters before and after an 80-hour stability test and by defining the existence of temperature, flow rate, subcooling, and time order (wear) dependencies. Meters were evaluated with flow rates ranging from 0.00126 to 0.0063 cu m/s 20 to 100 gpm), pressures ranging from 0.22 to 0.77 MN/ sq m (32 to 112 psia), and with temperatures ranging from 72 to 90 K. Author

N71-32757*# Environmental Science Services Administration, Rockville, Md.
HIGH LEVEL CLOUD PHOTOGRAPHY SAMPLES
In its BOMEX Bull., No. 7 Jul. 1970 p13–18 (See N71-32755 19-34)
Avail: NTIS CSCL 14E

A description, and examples are presented of the high level cloud photography during BOMEX. Illustrations of the flight tracks flown are given which indicate the photograph position and time. D.L.G.

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N71-31864# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
PROJECT HELIOS: TESTING OF ROTATING MECHANISMS UNDER SPACE ENVIRONMENTAL CONDITIONS [PROJEKT HELIOS: ERPROBUNG VON DREHMECHANISMEN UNTER WELTRAUMBEDINGUNGEN]
E. Birkhold, M. Granzow, P. Grossner, G. Hauser, and H. R. Treffon Bad Godesberg, West Ger. Bundesmin. fuer Bildung und Wiss. Mar. 1971 156 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Bildung und Wiss.
(BMBW-FB-W-71-13) Avail: NTIS; ZLDI Munich: 32.80 DM

Theoretical and experimental work on rotating mechanisms for a solar probe is dealt with. The development of a bearing for a despun antenna and the results of experiments relating to slit encapsulation and lubricants are described. The development of various mechanical drives and gears for a solar probe is demonstrated. ESRO

N71-31744# Aviation Electric, Ltd., Montreal (Quebec).
CLOSURE TECHNIQUE FOR LARGE BEARINGS ON AIRCRAFT WHEELS Final Report, Aug. 1967 – Jun. 1969
Wright-Patterson AFB, Ohio ASD Mar. 1971 59 p
(Contract F33657-67-C-1527)
(AD-723679; AETR-13857; ASD-TR-70-52) Avail: NTIS CSCL 13/9

Aircraft wheels incorporating large bearings (10 inches diameter and larger) have been subject to problems relating to grease retention. The project included inspecting a number of F-4C aircraft wheels during overhaul at MacDill Air Force Base. Tests of various designs of seals were then conducted at Aviation Electric Limited to determine if a satisfactory method of sealing such bearings could be developed. As a result of the investigation, it was concluded that the failure of F-4C wheel bearings was due to loss of grease. Tests indicated that several orders of magnitude improvement in bearing seals could be realized. One design is directly interchangeable with existing seals and two designs require some wheel modification; however, these designs could be incorporated in new wheels with very little difficulty. Author (GRA)

N71-31903# Allmanna Svenska Elektriska A. B., Vasteras (Sweden).
A NEW DEVELOPMENT IN METALLURGICAL PROCESSING
Y. Sundberg and M. Tiberg (Svenska Kullagerfabriken Stael) *In* Roy. Swed. Acad. of Eng. Sci. Clean Steel, Vol. 1 1971 p 20 – 28 (See N71-31901 19-17)
Avail: NTIS

A description is given of the double furnace jointly developed by two Swedish companies, SKF and ASEA. The structure consists of an electric-arc furnace with two shells and equipment for preheating of gas or oil with air. When used with a new melting/refining (MR) system, highest quality steel can be made in the cheapest possible way. ESRO

N71-31908# Sandvikens Jernwerks, A. B. (Sweden).
ELECTROSLAG REMELTING WITH DIRECT CURRENTS
G. Gruenbaum and K. Gustafsson *In* Roy. Swed. Acad. of Eng. Sci. Clean Steel, Vol. 1 1971 p 58 – 74 refs (See N71-31901 19-17)
Avail: NTIS

A description is given of the general electroslag refining (ESR) practice used at Sandvik. It includes direct current, electrode negative, high fill ratio, protective argon atmosphere, 60% CaF2/40% CaO-slag, and cold slag starting. Good oxygen and sulfur removal is obtained with this practice, whereas deviations from it are shown to affect the cleaning effect adversely. A very low content of micro- and macro-inclusions is achieved. ESR-material in titanium stabilized austenitic grades shows complete absence of subsurface titanium stringers. A structural analysis shows that high-speed steel and high carbon ball bearing steel with a favorable structure can be produced with the described ESR-practice. The hot workability is improved and explanations are offered for the noted effects. Author (ESRO)

N71-31909# Fagersta Bruks A. B., (Sweden).
THREE STEEL MAKING PROCESSES AND THEIR INFLUENCE ON INCLUSION CONTENT
Ch. Blomquist *In* Roy. Swed. Roy. Acad. of Eng. Sci. Clean Steel, Vol. 1 1971 p 75 – 81 refs (See N71-31901 19-17)
Avail: NTIS

The three steel making processes in use at Fagersta Bruks AB, Sweden, are briefly described and their influence on the inclusion content of carbon, low alloy, and stainless steels discussed. ESRO

N71-31915# Volvo R and D, Goeteborg (Sweden).
MACHINABILITY INVESTIGATIONS ON A CARBURIZING STEEL
S. Gunnarson *In* Roy. Swed. Acad. of Eng. Sci. Clean Steel, Vol. 1 1971 p 130 – 141 refs (See N71-31901 19-17)
Avail: NTIS

A study is made, from the aspect of machinability, of a number of metallurgical variants of a chromium-manganese carburizing steel. Testing of tool wear of annealed gear blanks in a production machining line is described. A number of laboratory tests in turning with carbide tools, milling, and face turning are considered. ESRO

N71-32055# Kernforschungsanlage, Jeulich (West Germany). Zentralinstitut fuer Reaktorexperimente.
HIGH-TEMPERATURE BRAZING OF THERMOELEMENTS AND PIPE DUCTS ON REACTOR PLUGS FOR REACTOR EXPERIMENTS [HOCHTEMPERATURLOETEN VON THERMOELEMENT- UND ROHRDURCHFUEHRUNGEN AN REAKTOREINSCHUEBEN FUER REAKTOREXPERIMENTE]
W. Lehrheuer and R. Lison Jul. 1970 49 p refs In GERMAN
(JUL-681-RX) Avail: AEC Depository Libraries

Brazing studies were made with two solders and three construction materials in all possible combinations. No tests of the mechanical properties nor the effects of a heat treatment on the solder joints were carried out. The only heat treatment was the cooling time caused by the slowness of the oven. The BNi-5 solder is suitable for soldering on the austenitic high-alloy steel 1.4541. Joining of high-alloy steel with Nb or Ta is to be only conditionally recommended. They contain no fissures but after introduction to increased temperatures fissures are expected because of an interdiffusion of Nb and solder or high-alloy steel elements. Joining of Nb – Nb, Ta – Ta, and Nb – Ta with BNi-5 solder is not useful because of the fissures occuring. The BNi-7 solder is more difficult to handle than BNi-5. For the joining of high-alloy steel to high-alloy steel, the temperature pattern in the oven available was not the best for a solder-material diffusion. Author (NSA)

N71-32099 National Lending Library for Science and Technology, Boston Spa (England).
A STATISTICAL METHOD OF MEASURING THE THICKNESS OPTICAL FIBRES
D. Sostak et al 17 Nov. 1970 11 p refs Transl. into ENGLISH from Monatsber. Deut. Akad. Wiss. (West Germany), v. 10, no. 8, 1968 p 604 – 612
(NLL-PORS-Trans-2673-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The problems involved in measuring the thickness of optical glass fiber the elements of fiber, the core, and shell, are stated. A static method is given for the quantitative evaluation and

qualitative assessment of fibers. It is based on electron microscope photographs of cross- and longitudinal-sections of the fibre. The fiber is etched to make the fibre elements stand out in relief and is photographed under an electron microscope. Several methods of application are discussed. Author

N71-32137*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OPERATION OF LOW SPEED GALLIUM LUBRICATED TUNGSTEN SLIPRING ASSEMBLY IN VACUUM FOR 500 HOURS
John S. Przybyszewski Washington Aug. 1971 21 p refs
(NASA-TN-D-6436; E-6317) Avail: NTIS CSCL 11H

A gallium lubricated tungsten slipring assembly (hemisphere on disk) showed good performance for 500 hr in vacuum at 132 mm/min carrying a current of 20 A dc, hemisphere positive. The gallium film was initially displaced from the wear track but gradually returned to reform a continuous film at 200 hr. Contact resistance was 0.065 m Omega, and contact noise was 0.009 m Omega, peak to peak at 500 hr. Coefficient of friction began at 0.25 but increased rapidly to 0.30 during the 38- to 40-hr period. Disk wear was very small. Hemisphere wear rate was 9.8 × 10 to the minus 9th power cu mm/mm sliding. Surface irregularities immediately outside of the actual contact area were suggestive of minute attack by gallium. Postexperiment analysis of gallium film did not detect tungsten. Author

N71-32169 National Lending Library for Science and Technology, Boston Spa (England).
THE EFFECT OF BASIC PARAMETERS ON THE DYNAMIC COEFFICIENT OF FRICTION THERMOPLASTICS
R. Brezik 1 Jul. 1970 13 p refs Transl. into ENGLISH from Plasticke Hmoty a Kauck (USSR), v. 6, no. 10, 1969 p 299–302
(NLL-RISLEY-Trans-1928-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The effect of basic parameters (temperature of surface of friction wheel, sliding speed, normal forces, surface roughness of the friction wheel and slipping time in long-duration tests) on the dynamic coefficient of friction of thermoplastics (branched-chain polyethylene, polypropylene, PVC, polyamide, polymethyl methacrylate, tough polystyrene, polytrifluorochlorethylene and polytetrafluoroethylene) was studied on a prototype tribometer constructed for evaluating static and dynamic coefficients of friction. Author

N71-32176# Defense Documentation Center, Alexandria, Va.
WEATHERPROOFING, INDUSTRIAL PROCESSING SERIES, VOLUME 1 Report Bibliography Dec. 1959–Feb. 1970
Mar. 1971 174 p refs
(AD-722801; DDC-TAS-70-89-1-Vol-1) Avail: NTIS CSCL 13/8

The volume includes 117 annotated references arranged in AD sequence and covers the period January 1953 to January 1971. Coporate author-monitoring agency, subject, title, personal author, contract, and report number indexes are included. Author

N71-32193*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LEAD, INDIUM, AND TIN AS POTENTIAL LUBRICANTS IN LIQUID HYDROGEN
Donald W. Wisander Washington Aug. 1971 12 p refs
(NASA-TN-D-6455; E-5880) Avail: NTIS CSCL 11H

Friction and wear experiments were conducted in liquid hydrogen using AISI 440 C riders in sliding contact with coated 440 C disks. These experiments revealed that thin coatings of lead, indium, or tin can function, for short times useful in rocket vehicles, as solid film lubricants in sliding contact. All three metal films lubricate by forming a transfer film on the mating surface which prevents welding or galling. Ion-plated coatings gave lower friction and better antigalling protection than the electroplated coating of the same metal. Lead gave the best results of the three metal coatings used. Author

N71-32214# Scientific Translation Service, Ann Arbor, Mich.
DYNAMIC TESTS ON TANGENTIAL PIPE FITTINGS. PART 1: TEST RESULTS
Godfried Stockman et al [1971] 27 p refs Transl. into ENGLISH from French report CRIF-MT-28 Sponsored by AEC Prepared for ORNL
(ORNL-tr-1991; CRIF-MT-28) Avail: NTIS

The extent to which the dimensional regulations for straight and inclined pipe fittings remain valid is investigated. Results reported concern stress measurement on eight tanks equipped with a tangential pipe fitting and differing in terms of type as well as dimensions of the cylindrical vessel component and the fittings. Author

N71-32241# Defense Documentation Center, Alexandria, Va.
MERCURY LAMPS: A DDC BIBLIOGRAPHY, VOLUME 1, MAY 1961–MARCH 1970
Apr. 1971 82 p refs
(AD-722860; DDC-TAS-71-2-1-Vol-1) Avail: NTIS CSCL 13/1

Selected references are from the Defense Documentation Center's collection on Mercury Lamps and related lighting equipment. References deal with illuminants equipped with powerful xenon lamps, development of infrared sources, ocular effects of thermal radiation, spectral flash lamps, operating characteristics of a xenon-mercury short-arc lamp immersed in water, and the underwater visibility of colors with artificial illumination are discussed. Author

N71-32316# Bendix Corp., Kansas City, Mo.
PRESSURE AND TEMPERATURE GRADIENTS IN TRANSFER MOLDING OF ELECTRONIC ASSEMBLIES
F. H. Lewis Apr. 1970 158 p refs
(Contract AT(29-1)-613)
(BDX-613-333) Avail: NTIS

A specially designed strain gage transducer was used to determine pressure exerted upon parts and electronic assemblies during encapsulation by transfer molding. Encapsulation of the transducer and thermocouples in the molding compound were used to determine pressure buildup and decay, simultaneously with the temperature variation during the molding cycle. Pressure buildup during molding was shown to reach a peak value lower than the transfer pressure, while peak cavity temperature approached 100 F above the mold temperature. Results of these experiments and a simplified mathematical analysis provided new capabilities for use in future transfer molding applications. Author

N71-32360 Colorado Univ., Boulder.
DEVELOPMENTS OF FLOWGRAPHS IN MECHANICAL SYSTEMS AND DESIGN
Thorleif Enger (Ph.D. Thesis) 1969 396 p
Avail: Univ. Microfilms Order No. 70-16481

The application of flowgraphs to mechanical structures and hydraulic pipeline networks was investigated. The formulation of a system flowgraph was obtained by generating a set of building blocks. The building blocks which describe physical subsystems were interconnected by constraint flowgraphs. In the general force and displacement method of structural analysis, the building blocks express continuity and equilibrium conditions. In the analysis of hydraulic pipeline networks, mesh rate of flows and junction head values were treated as system variables. Both a linear and nonlinear analysis of the network problem were considered. In the formulation of nonlinear characteristics, a variational form of the graph technique was employed. An approximate analysis by finite difference flowgraphs was illustrated for initial value problems and

boundary value problems. Of particular interest was the solution of boundary value problems governed by the Laplacian and Poissonian operator. A sensitivity analysis by flowgraph methods was included. The dynamic response of linear mechanical systems was also investigated. Dissert. Abstr.

N71-32396# National Bureau of Standards, Washington, D.C.
US METRIC STUDY: ENGINEERING STANDARDS Interim Report
Jul. 1971 256 p refs 11th in a ser. of Rept. prepared for the Congress
(NBS-SP-345-11) Avail: SOD $2.00

Results of an investigation of the probable impact of U.S. conversion to the metric system of measurement on engineering standards are reported. The work was initiated by Congressional authorization of the U.S. Metric System Study and was conducted by the National Bureau of Standards. Consideration was given to the advantages, disadvantages, and problems associated with possible changes in either the system of measurement units or the related dimensional and engineering standards in current use. A.C.R.

N71-32419# British Iron and Steel Research Association, London (England). Plant Engineering and Energy Div.
CONTROL OF GAUGE AND SHAPE IN FLAT ROLLING
B. Sabatini and M. Tarokh 30 Oct. 1969 14 p refs
(PB-198368; BISRA-PE/B/28/69) Avail: NTIS CSCL 13I

An algorithm for the integrated control of gauge and shape is presented. Based on this, a control scheme is proposed. The conditions under which separate control of gauge and shape is satisfactory are examined. Author (GRA)

N71-32432# Joint Publications Research Service, Washington, D.C.
NEW CASTING METHODS
Ye. Muslin et al 12 Jul. 1971 6 p Transl. into ENGLISH from Ekonhk. Gazeta (Moscow), no. 24, Jun. 1971 p 24
(JPRS-53572) Avail: NTIS

Hot casting methods are discussed that make it possible to obtain metal parts of 5 to 2 mm thicknesses at 5 to 6 m lengths and 2 m widths. One hot pressing process utilizes extensible foundry molds consisting of two halves that draw together after the die cavity is filled so that the melt excess splashes out; the ready metal part is removed after separation of the two folds. A method of gasified pattern casting uses foamed and dried granules of polystyrene loads in foundry molds that are transformed into a colorless gas when they come into contact with the incandescent molten metal during mold casting; the gas is then replaced by the liquid metal. Economic estimates indicate that the latter forming process saves more than 50 kilograms of metal per ton of castings. G.G.

N71-32649 National Lending Library for Science and Technology, Boston Spa (England).
A NEW METHOD OF DEPOSITING SILICON NITRIDE FILMS ONTO SILICON
H. J. Schnabel 17 Nov. 1970 9 p refs Transl. into ENGLISH from the German report
(NLL-PORS-Trans-2700-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A new method for deposition of silicon nitride films onto silicon is described and its effectiveness evaluated. Amorphous silicon nitride is deposited by passing an RF discharge between silicon electrodes in a flow of N2/H2 at normal pressure onto a heated silicon substrate. The chief advantages of this technique over other semiconductor deposition methods are its lower cost and relatively simple handling. Author

N71-32658 National Lending Library for Science and Technology, Boston Spa (England).
PARAMETRIC AND NONPARAMETRIC STATISTICAL METHODS FOR ESTIMATING THE RELIABILITY OF MECHANICAL COMPONENTS
D. Basile et al 5 Oct. 1970 53 p refs Transl. into ENGLISH from Euratom Eur., 4282i, 1969
(NLL-CE-Trans-5427-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 5 NLL photocopy coupons

Statistical methods which make it possible to estimate the probability of failure of a mechanical component, using experimental data obtained from tests on the actual components are examined. Parametric methods (application of the maximum likelihood principle) and nonparametric methods (order statistics) are included. Particular attention is also given to the use of probability cards, and the Weibull distribution. Three computer programs are presented (IBM360/65) concerning determination of the Weibull parameter, the ranks for fixed levels of confidence, and application of the Kolmogoroff test. Author

N71-32706# Lund Inst. of Tech. (Sweden). Machine Elements Div.
ON THE LUBRICATION OF HEAVILY LOADED SPHERICAL SURFACES CONSIDERING SURFACE DEFORMATIONS AND SOLIDIFICATION OF THE LUBRICANT
Bo Jacobson Stockholm Roy. Swed. Acad. of Eng. Sci. 1970 60 p refs Acta Polytech. Scand. Mech. Eng. Ser. No. 54
(PB-198321) Avail: NTIS CSCL 11H

Lubrication of a point contact between two spheres is studied. The viscosity of the oil is assumed to vary with pressure and temperature. The oil is assumed to be solidified above a certain pressure, which is dependent of the temperature. The solidified oil is assumed to have a shear strength independent of pressure and temperature. Continuity conditions for the cavitation boundary between liquid oil and solidified oil, and the boundary between sliding and non-sliding solidified oil are given. Numerical calculation of height functions, pressure distributions, and load capacities are made for the isothermal case. Author (GRA)

N71-32718 National Lending Library for Science and Technology, Boston Spa (England).
DATA AQUISITION SYSTEM FOR DETERMINING RELIABILITY CHARACTERISTICS
D. Schlothauer [1970] 12 p Transl. into ENGLISH from the German report
(NLL-RISLEY-Trans-1920-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A data acquisition system is described for determining component reliability. The registration of component characteristics and failure modes for selecting sampling sizes is discussed as well as failure rate determination. Differentiation of components according to power station, constructional element, component group, consecutive number, manufacturer, component data, and operating time is included along with the data collection and evaluation procedures. J.M.

N71-32746# Lund Univ. (Sweden). Machine Elements Div.
STRESSES IN EXTERNAL INVOLUTE SPUR GEARS
Erik Wennerstrom Stockholm Roy. Swed. Acad. of Eng. Sci. 1970 67 p refs
(PB-198320; APS-ME-53) Avail: NTIS; Sw. kr. 10.00 CSCL 13I

Contact and bending stresses in external involute spur gears are treated. Nondimensional parameters based on equal center distance and equal torque on the pinion are derived. These parameters are suitable for an optimum analysis showing the advantage of using modified gears. Numerical solutions of the plane elastic problem of a gear tooth are presented. From one solution the principal stresses and their differences are calculated. Author

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N71-31809*# Bendix Corp., Ann Arbor, Mich. Aerospace Systems Div.

DESIGN CERTIFICATION REVIEW REPORT FOR THE APOLLO 15 LASER RANGING RETRO-REFLECTOR EXPERIMENT

15 Jul. 1971 33 p

(Contract NAS9-5829)

(NASA-CR-115108; BSR-3148) Avail: NTIS CSCL 20E

Detailed documentation is provided of the design certification of the Apollo 15 Laser Ranging Retro-Reflector -300 corner (LRRR(300)) experiment. The information presented illustrates the design maturity of the LRRR (300) and its suitability for use in manned space flight. A brief review is given of the Apollo Lunar Surface Experiments Package (ALSEP) Program background, the Early Apollo Scientific Experiments Package (EASEP) LRRR experiment, the Apollo 14 LRRR and the LRRR design objectives. Following a description of the performance required of the LRRR (300) during the Apollo 15 mission and lunar surface operation, the program of testing this performance is outlined. The results of the Apollo 15 LRRR (300) test program are summarized to show that the LRRR designed for this lunar surface experiment meets the specified requirements. Reference is also made to testing previously conducted on the EASEP and Apollo 14 LRRR experiments. Author

N71-31807# Institute for Defense Analyses, Arlington, Va. Jason Div.

THEORETICAL STUDY OF IONIZATION OF AIR BY INTENSE LASER PULSES

Norman Kroll and Kenneth M. Watson Dec. 1970 85 p refs

(Contract DAHC15-67-C-0011)

(AD-723183; IDA/HQ-71-12212; P-733) Avail: NTIS CSCL 7/4

A detailed theoretical study of cascade ionization of air by radio frequency fields and by laser beams is given. Experimental rate constants for energy loss, ionization, and attachment are used. The Boltzmann equation for the electrons is solved in both classical and quantum form. Provision is made for both single-and multi-photon ionization and detachment processes. The latter processes have been incorporated parametrically in our calculations due to the lack of quantitative description of multi-photon absorption. Possible anomalies in comparison with available experiments are noted for photons in the one to two electron volt range when the illuminated volume is large. Author (GRA)

N71-31844*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

COMPARISON OF C-BAND, SECOR, AND TRANET WITH A COLLOCATED LASER ON 35 TRACKS OF GEOS-2

H. Parker, D. Carney, and J. Berbert *In its* Proc. of the GEOS-2 Program Rev. Meeting, Vol. 2 Nov. 1970 p 1–10 (See N71-31843 19-13)

Avail: NTIS CSCL 20E

The analyses results of simultaneous collocated laser and C-band, SECOR, and TRANET radio tracking data for 35 GEOS-2 passes are presented. The effects of preprocessing data changes, including rewriting the CDC-3200 computer C-band preprocessing program for the IBM 360 computer with calibration constants computations, SECOR data correction for a scale factor error, and TRANET data correction for base frequency computation error, on the tracking data from 10 GEOS-2 passes were analyzed. The preprocessing changes caused the C-band bias values for a few passes to shift by several meters and caused the SECOR bias to be more negative by about 2.5 meters on all passes. The preprocessing changes in the TRANET data reduced the previous biases from 15.6 and 17.6 cm/sec to −3.4 and 1.5 cm/sec. J.M.

N71-31845*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

CARNARVON LASER COLLOCATION EXPERIMENT (CALACO)

J. M. Hlavin (RCA Service Co., Inc.) and J. H. Berbert *In its* Proc. of the GEOS-2 Program Rev. Meeting, Vol. 2 Nov. 1970 p 11–24 refs Presented at the Natl. Fall AGU Meeting, San Francisco, Dec. 1969 (See N71-31843 19-13)

Avail: NTIS CSCL 20E

A mobile laser experiment in Carnarvon, Australia, for evaluating the accuracy of the Goddard Range and Range Rate (GRARR) system and the FPQ-6 C-band radar system is described. The GRARR satellite tracking operating principles are summarized as well as the tracking data and data analysis procedures including corrections. The laser/GRARR GEOS-2 satellite tracking test statistics are tabulated. It was concluded that the laser could support scheduled tracking, at a remote site since the laser measurement statistics showed no significant difference between day and night tracking. J.M.

N71-31846*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

LASER/LASER COMPARISONS FROM THE GORF, ARLACO, AND GOLACO TESTS

J. H. Berbert, J. M. Hlavin (RCA Service Co., Inc.), and R. F. Reich (RCA Service Co., Inc.) *In its* Proc. of the GEOS-2 Program Rev. Meeting, Vol. 2 Nov. 1970 p 26–44 refs (See N71-31843 19-13)

Avail: NTIS CSCL 20E

Preliminary satellite tracking performance results from the two Goddard mobile laser (GML) tests with the collocated Goddard experimental laser (GEL) at Goddard and one with the Smithsonian Astrophysical Observatory (SAO) laser at Mt. Hopkins, Arizona are compared. A chronological plot of range bias of the GEL or SAO laser, relative to the GML, is plotted for each pass of the three intercomparison tests: GORF 1, ARLACO - phases 1 and 2, and GOLACO. A summary of the average range noise and average relative bias over all passes within each intercomparison test is given. Author

N71-31850*# Smithsonian Astrophysical Observatory, Cambridge, Mass.

A TWO LASER COLLOCATION EXPERIMENT

M. R. Pearlman, C. G. Lehr, G. M. Mendes, and M. R. Wolf *In* NASA. Goddard Space Flight Center Proc. of the GEOS-2 Program Rev. Meeting, Vol. 2 Nov. 1970 p 99–114 refs (See N71-31843 19-13)

(Grant NGR-09-015-002)

(SAO-006-92) Avail: NTIS CSCL 20E

A two-laser collocation experiment was performed on the Geos 2 satellite with the Smithsonian Astrophysical Observatory (SAO) prototype ranging system and the NASA mobile laser unit to determine the relative accuracy of these two laser systems, both of which are being used in the routine collection of satellite geodetic data. The effort was conducted at the SAO Observatory at Mt. Hopkins, Arizona, during the period October 1969 to January 1970. The two laser systems demonstrated a relative accuracy of 1 to 2 m, determined from short-arc single-pass calculations. From a point-by-point analysis of near-simultaneous satellite returns, the displacement of the collocated lasers was extracted to an accuracy of a few meters over a baseline of ap-

proximately 130 m. The laser data were also included in 2-week long-arc calculations to which Baker–Nunn camera data were added. Laser range residuals of 10 m or better and angular-data residuals of 3 to 6 arcsec were achieved. From the long-arc analysis, relative station positions were determined to better than 10 m. Author

N71-31857*# Smithsonian Astrophysical Observatory Cambridge, Mass.
FUTURE USES OF LASER TRACKING
E. M. Gaposchkin *In* NASA. Goddard Space Flight Center Proc. of the GEOS-2 Program Rev. Meeting, Vol. 3 Nov. 1970 p 1–42 refs (See N71-31856 19-13)
(Grant NGR-09-015-002)
Avail: NTIS CSCL 20E

Methods of determining the earth's gravity field are discussed, and includes a classical satellite tracking, gravimetry, and laser satellite tracking. Satellite perturbation equations, sensitivity coefficients for geodetic satellites, are given, and laser operational modes and alternate methods of data determinations are described. The accuracies expected with different laser satellite systems are determined and the computer calculations are mentioned. Kinematic properties such as earth tides, polar motion, and crustal motion can also be studied by means of the d laser data. N.E.N.

N71-31861*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GODDARD MOBILE LASER (MOBLAS) SYSTEM DESCRIPTION
Don A. Premo *In its* Proc. of the GEOS-2 Program Rev. Meeting, Vol. 3 Nov. 1970 p 101–114 (See N71-31856 19-13)
Avail: NTIS CSCL 20E

The tracking pedestal, system characteristics, data handling, and sample data of the laser tracking system are described. The laser system is a pulsed ruby laser radar designed primarily to track satellites equipped with optical corner reflectors. The advantages are considered to be that it is easy to decide which points are acceptable, it is easy to implement operational functions, a good range of measurement geometry is obtained, and the data are processed and transmitted within hours. N.E.N.

N71-32093# Aerospace Corp., El Segundo, Calif. Office for Technology.
GAUSSIAN ILLUMINATION OF A CIRCULAR APERTURE Technical Report, 30 Jan.–22 Dec. 1970
Donald H. Martin 13 Apr. 1971 17 p refs
(Contracts F04701-70-C-0059; F04701-69-C-0066)
(AD-722433; TR-0059(6310)-1; SAMSO-TR-71-66) Avail: NTIS CSCL 20/5

An expression is developed for the far-field power distribution for a circular aperture with Gaussian illumination. Particular attention is given to the case where it is desired to maximize the far-field axial power density. Author (GRA)

N71-32244# Air Force Systems Command, Wright-Patterson AFB, Ohio. Flight Dynamics Lab.
A TECHNIQUE FOR OBTAINING IMPROVED REAL-TIME HOLOGRAPHIC INTERFEROMETRIC DATA USING PULSE MODULATED ILLUMINATION Summary Report, Nov. 1969–Sep. 1970
Frank D. Adams and Gene E. Maddux Oct. 1970 69 p refs
(AD-723632; AFFDL-TR-70-173) Avail: NTIS CSCL 14/5

Calculations and experiments were performed to show that the fringe patterns on a vibrating structure, as observed using real-time holographic interferometry, has a substantially increased contrast ratio if the laser illumination is amplitude modulated by a sequence of pulses which are synchronized with the vibration. The time and effort required to obtain interferometric data using this method is an order of magnitude less than that needed when using time-average holographic interferograms. Potential applications include experimental studies of fatigue damage, crack detection and propagation, flaw detection in composite and honeycomb structures as well as vibration analysis of structural members. Author (GRA)

N71-32285 Maryland Univ., College Park.
RAMAN SPECTRA OF SELECTED MOLECULES EXCITED BY A LOW POWER HELIUM-NEON GAS LASER
Thomas Edward Kenney (Ph.D. Thesis) 1969 67 p
Avail: Univ. Microfilms Order No. 70-15404

A low power helium-neon gas laser was used as a source lamp for Raman spectroscopy and was compared to a mercury arc used for the same purpose. A number of molecules were analyzed and the results presented. Vibrational assignments for certain of the molecules were made. Dissert. Abstr.

N71-32382*# National Aeronautics and Space Administration, Washington, D.C.
OPTICAL DEVICES: LASERS, A COMPILATION
1971 27 p refs
(NASA-SP-5937(01)) Avail: NTIS CSCL 20E

Laser applications and laser devices are briefly discussed from the viewpoint of possible transfer of technology. The ways in which lasers are being applied in measurement of various phenomena in communications, industrial fabrication, and in computer systems are surveyed. Components, tubes, and techniques used in connection with the generation, modification, or control of a laser beam are described. N.E.N.

N71-32445# Southwestern Radiological Health Lab., Las Vegas, Nev.
THE DESIGN AND CONSTRUCTION OF A LASER METER FOR THE MEASUREMENT OF CW IRRADIANCE AT 6328 NANOMETERS
Richard W. Peterson, Wilbur F. Van Pelt, and Harold F. Stewart Nov. 1970 26 p refs
(PB-198375; BRH/SWRHL-70-2) Avail: NTIS CSCL 20F

A description of the design and construction of a meter capable of measuring scattered levels of irradiance (power density) resulting from the operation of low power, continuous wave, helium-neon gas lasers is presented. The readily available components which were used, the techniques for calibration, and operation of the instrument are discussed. The instrument responds to irradiances of microwatts/sq cm or greater depending on the aperture size selected by the user. Author (GRA)

N71-32457# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE POSSIBILITY OF PRODUCING AN X-RAY LASER IN A PLASMA
G. I. Gudzenko et al [1970] 3 p refs Transl. into ENGLISH from Nauka i Tekh. (Minsk), 1970, p 478–480
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The difficulties in producing an X ray laser are discussed. The difficulties are associated primarily with the fact that the gain coefficient in the inversely populated medium drops sharply as the wavelength decreases. A numerical analysis of the conditions which counter indicate the feasibility of the X ray laser is provided. Author

N71-32630# Rutherford High Energy Lab., Chilton (England).
A LASER ILLUMINATION SYSTEM FOR A HOUGH-POWELL DEVICE

R. A. Lawes and W. T. Welford Feb. 1971 38 p refs
(RHEL-R-212) Avail: AEC Depository Libraries; HMSO 10s; BIS $2.10

An HPD illumination system is described which uses an argon laser and requires a minimum of modification to the existing optomechanical structure. A diffraction limited measuring spot of 3 microns diameter (at 50% intensity) is obtained at a power level of approximately 1 microwatt. Photon noise effects are consequently reduced to negligible proportions for known applications of the machine. Author (NSA)

N71-32684 Arkansas Univ., Fayetteville.
LASER STUDIES: COHERENT DYNAMIC EFFECT AND ABSORPTION COEFFICIENT MEASUREMENTS FOR CARBON DIOXIDE
Carl Edwin Halford (Ph.D. Thesis) 1970 100 p
Avail: Univ. Microfilms Order No. 70-17191

The generation and propagation of picosecond pulses is discussed. Relaxation of the off – diagonal elements of the density matrix is included throughout the work. The steady state pulse in a two level system with homogeneous broadening is investigated to determine under what conditions it is a 180 deg pulse. It is shown that the steady state pulse can be a 0 deg pulse, a 90 deg pulse, or a 180 deg pulse. The 0 deg pulse analysis leads to an attractive explanation of multiple pulses. The equations for the system are adapted to a laser operation in a single longitudinal mode. A closed form solution is obtained for these equations for a particular set of parameters and for boundary conditions chosen for an oscillator. The effect of host dispersion is considered by investigating the effect of propagating a hyperbolic secant pulse in a dispersive medium. Several pulsewidths are considered and typical host materials are investigated. Dissert. Abstr.

N71-32686# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif. Independent Research and Development Program.
LUMINESCENCE INDUCED BY UV AND VISIBLE LASERS FOR THE REMOTE ACTIVE SENSING OF MATERIALS FROM GROUND, AIR, AND SPACE
H. Gerald Gross and Howard A. Hyatt Jun. 1971 32 p refs
(MDG-G2344) Avail: NTIS

It was found that: (1) the same signature luminescence spectra can be produced with visible laser irradiation lines as with the classic ultraviolet, X-ray, or charged particle irradiation in a wide variety of materials; and (2) the characteristic broad luminescent band of a material can be produced either totally by any laser line shorter than the band, or partially by any laser line within the band. The spectra, bandwidths, and quantum efficiencies for a preliminary set of six materials (ground surface, plastic coating, biological, geological metallic, and fish and mineral oils) are presented and discussed. Author

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N71-31671# Dow Chemical Co., Freeport, Tex.
SEAWATER CORROSION TEST PROGRAM
H. C. Behrens, O. Osborn, L. Rice, C. F. Schrieber, and B. P. Webb
Dec. 1970 123 p refs
(Contract DI-14-01-0001-2150)
(PB-198638; OSW-PR-623) Avail: NTIS CSCL 11F

The hot seawater performances of mild steel, a high-strength, low alloy steel, three experimental low alloy steels, four stainless steel wrought and cast alloys, seven aluminum alloys, and one Alclad composition are discussed. Variables of dissolved oxygen, temperature, velocity, pH, and refreshment rate of seawater were considered. Low alloy steel corrosion rates were 30 percent less than mild steel for the same oxygen concentration. This advantage was pronounced through 300-ppb oxygen concentration levels. Mild steel was sensitive to temperatures above 225 F; less sensitive below. Optimum condition for aluminum alloys in hot seawater is acidic pH at 50 to 100 ppb oxygen. Aluminum is possibly independent of oxygen after preconditioning. Alloys 3003 and 5454 showed highest level of performance. Al clad alloy 7072 self corrosion rate was too high for satisfactory service life.
Author (GRA)

N71-31673# Westinghouse Electric Corp., Pittsburgh, Pa.
DEVELOPMENT OF A LOW-COST IRON-BASE ALLOY TO RESIST CORROSION IN HOT SEA WATER Research and Development Progress Report
N. Pessall, F. C. Hull, and C. Liu Dec. 1970 83 p refs
(Contract DI-14-01-0001-2299)
(PB-198642; OSW-PR-627) Avail: SOD $0.75; NTIS CSCL 11F

Iron-base alloys, ranging from binary alloys of Fe-Cr to multicomponent alloys based on Fe-Cr-Mo, were prepared by levitation melting. The relative resistances to pitting corrosion in deaerated synthetic sea water, at temperatures up to 194 F, were evaluated on the basis of critical pitting potentials, E sub c, obtained from anodic polarization measurements. A new method for determining the E sub c values is discussed. The more highly resistant base alloys are Fe-Cr-W, Fe-Cr, Mo, Fe-Cr-Mo-Re and Fe-Cr-Mo-Co. To reduce cost, while retaining corrsoion resistance, combinations of elements were successfully determined, based on electronic structure considerations, which can be substituted, wholly or partly, for the chromium molybdenum, and cobalt components. It is concluded that by judicious selection of such substitutes, an economical ferritic steel with adequate mechanical and corrosion properties for use in hot sea water environments is feasible.
Author (GRA)

N71-31684# Fraunhofer Institut, Freiburg (West Germany).
INVESTIGATION OF THE FRACTURE CHARACTERISTICS OF SYNTHETIC WELDED JOINTS OF MEDIUM STRENGTH STEEL N-A-XTRA 70 [UNTERSUCHUNGEN UEBER DAS BRUCHVERHALTEN VON SYNTHETISCHEN SCHWEISSGEFUEGEN DES MITTELFESTEN STAHLS N-A-XTRA 70]
Dietmar Bechert Oct. 1970 38 p refs In GERMAN Sponsored by Bundesmin. fuer Verteidigung
(Rept-8/70) Avail: NTIS

The complex strength and toughness characteristics of a medium strength steel N-A-XTRA 70 weld in the thermally influenced zone near the welding zone, are investigated. Homogeneous synthetic welded joints are simulated in tensile and notch tests. The investigations lead to an explanation of the influence of several heat treatment cycles on joint forming and on strength and fracture characteristics. Author (ESRO)

N71-31704# Fraunhofer Institut, Freiburg (West Germany). Abteilung fuer Festkoerpermechanik.
CRACK VELOCITIES IN SILICON AND GERMANIUM [BRUCHGESCHWINDIGKEITEN IN SILIZIUM UND GERMANIUM]
John. H. Greenwood Aug. 1970 61 p refs In GERMAN Sponsored by Roy. Soc., London
(Rept-7/70) Avail: NTIS

The measurement of crack propagation velocities in silicon

and germanium using ultrasonic fractography is reported on. Of particular interest are the acceleration at crack initiation, the relation between velocity and the different types of fracture surfaces, and the maximum velocity. ESRO

N71-31730# IIT Research Inst., Chicago, Ill.
IMPROVEMENT OF THE CORROSION RESISTANCE OF ALUMINUM BRASS FOR USE IN SEAWATER CONVERSION PLANTS
Maurice A. H. Howes, A. Bright, K. Johnson, R. K. Nolen, and R. Wibel Washington US Dept. of Interior Dec. 1970 51 p refs
(Contract DI-14-01-0001-1770)
(PB-198643; OSW-PR-628) Avail: NTIS; SOD $0.50 CSCL 11F

Development of a selective oxidation process to yield a coherent corrosion resistant surface layer on aluminum brass is described for application to equipment used in sea water conversion plants. Sixteen atmosphere compositions were used at temperatures from 800 to 1400 F. It was found that the corrosion resistance of aluminum brass can be significantly improved by heating in partially oxidizing atmospheres at 1200 to 1400 F. These results are based on autoclave testing, and final conclusions cannot be drawn regarding the effectiveness of the enhanced surface layer until further loop tests are completed. However, at this stage selective oxidation seems a very promising way of reducing corrosion rate and improving the life of aluminum brass in seawater converters. Author (GRA)

N71-31745# Naval Air Development Center, Johnsville, Pa. Aero Materials Dept.
STRESS CORROSION RESISTANCE OF SILVER BEARING ALUMINUM ALLOYS Progress Report
Irving S. Shaffer 2 Apr. 1971 18 p refs
(AD-723583; NADC-AM-7069) Avail: NTIS CSCL 11/6

An investigation was made to determine the effect of silver addition on the stress corrosion resistance of Al-Zn-Mg-Cu alloys. Tests were conducted by alternate immersion in 3-1/2% Na Cl on two lots from two different sources. The silver bearing alloys displayed an increased susceptibility to pitting corrosion and a predominantly transgranular mode of cracking. No significant improvement in stress corrosion behavior was noted with silver addition as measured by time to cracking. Author (GRA)

N71-31746# Army Foreign Science and Technology Center, Charlottesville, Va.
PHYSICO-CHEMICAL PHENOMENA ASSOCIATED WITH THE ACTION OF LIQUID METALS ON SOLIDS, PART 1. MECHANISM OF REACTION OF LIQUID METALS ON SOLIDS IN A STRESSED STATE, PART 2
V. I. Nikitin 24 Feb. 1971 298 p refs Transl. into ENGLISH from Russian Report
(AD-723570; FSTC-HT-23-415-70-Pt-1-Pt-2) Avail: NTIS CSCL 11/6

In Part I, the book discusses the processes associated with the action of liquid metals on solids in stressed and unstressed states. The following corrosion action of liquid metals is described: the mechanisms of dissolution, non-isothermal and isothermal mass transfer, intercrystalline fracture, formation of compounds and solid solutions, effect of impurities in liquid metals, etc. The changes occurring in the mechanical properties of solid metals under the action of liquid metals during short duration tests and during long-term strength, creep and fatigue tests are also described. Adsorptive, corrosive and diffusive effects of liquid metals on solids in a stressed state are discussed. In Part II, the mechanism of the reaction of liquid metals on solids in a stressed state, is discussed in continuity with Part I. GRA

N71-31769# Battelle-Northwest, Richland, Wash. Pacific Northwest Labs.
INVESTIGATION OF GALVANICALLY INDUCED HYDRIDING OF TITANIUM IN SALINE SOLUTIONS
L. A. Charlot Dec. 1970 47 p refs
(Contract DI-14-30-2522)
(PB-198639; OSW-PR-624) Avail: SOD $0.50; NTIS CSCL 11F

Galvanically induced hydriding of commercially pure titanium and titanium-2 nickel alloy was determined in 3.4 wt percent NaCl air-sparged and argon-sparged solutions at 140, 265, and 390 F. Hydrogen charging of the titanium via couple assemblies of titanium to aluminum, titanium to mild steel, titanium to copper, titanium to nickel, and titanium to stainless steel was measured by high temperature vacuum extraction analysis of the exposed titanium metal. The presence of hydrogen in the titanium was verified by metallographic analysis of the exposed titanium metal, which also showed the distribution of hydrogen. Assessment of corrosion, apart from hybriding, of both members of the galvanic couple was made by weight change determinations and visual inspection. A corrosion performance ranking from least to most corrosion resistant for the metals coupled with titanium in the 140 F argon-sparged test is Al < < Mild Steel < Cu = Ni = Stainless Steel. In the 390 F air-sparged test the extent of corrosion of the dissimilar metals gave a ranking of Al < < Mild Steel < < Cu = Stainless Steel < Ni. GRA

N71-31770# Solar, San Diego, Calif.
APPLICATION OF IRON-ALUMINUM BASE ALLOYS TO SALINE WATER CONVERSION
E. R. Duffy and J. F. Nachman Washington US Dept. of Interior Dec. 1970 64 p refs
(Contract DI-14-01-0001-1796)
(PB-198641; OSW-PR-626) Avail: NTIS; SOD $0.60 CSCL 11F

In an attempt to develop an iron-aluminum alloy with resistance to sea water corrosion and minimum aluminum content, three test samples were fabricated, screened, and tested. Testing included systematic evaluation of sea water corrosion resistance of Alfenol (Fe + Al), Thermenol (Fe + Al + Mo), Modified Thermenol (Fe + Al + Mo + Zr). The two alloys with the highest aluminum content, along with the Thermenol alloy containing 10 percent aluminum, were selected for advanced testing. Neither baseline nor iron-aluminum alloys were severely attaked in the autoclave. The most severe attack occurred with a Modified Thermenol alloy with 16 percent aluminum in sea water steam at 280 F. This alloy was found to be the most corrosion resistant iron-aluminum alloy in moving sea water. The molybdenum-bearing iron-aluminum alloys with 14 and 16 percent aluminum were equal to or superior to cupro-nickel in velocity tests at room temperature. However, only the Modified Thermenol alloys with 16 percent aluminum approached the corrosion resistance of cupro-nickel at 190 F. GRA

N71-31796# Air Force Systems Command, Wright-Patterson AFB, Ohio. Air Force Materials Lab.
IMPROVED PROPERTIES OF Ti-6Al-6V-2Sn THROUGH MICRO-STRUCTURE MODIFICATION Technical Report, Jan.–Aug. 1970
J. A. Hall and C. M. Pierce Feb. 1971 32 p refs
(AD-723636; AFML-TR-70-312) Avail: NTIS CSCL 11/6

The fracture toughness of the Ti-6Al-6V-2Sn alloy in the annealed condition is greatly influenced by microstructural features which may vary considerably as a result of differing thermal-mechanical processing operations employed prior to the annealing heat treatment. The variety of microstructures which can result merely by heat treatment is categorized and the related tensile and toughness properties are presented. In instances where higher fracture toughness is desired, judicious heat treatment of the as-received material can often increase this property. Of the heat treatments employed in this investigation, the properties were most significantly improved by solution treating at 1710F for 60 minutes, air cooling, and subsequently heating to 1400F for one

hour followed by an air cool. The tensile strength of the alloy was increased from 150 to 155.6 ksi and the fracture toughness (K sub Q) was raised from 55.8 to 68.0 ksi sq in. Author (GRA)

N71-31901# Royal Swedish Academy of Engineering Sciences, Stockholm.
CLEAN STEEL, VOL. 1
1971 228 p refs Soviet-Swed. Symp. held at Sandviken, Swed., 24–26 Mar. 1971; sponsored by the Swed. Board for Tech. Develop. Sponsored by the Swed. Board for Tech. Develop.
(IVA-169-1) Avail: NTIS

Conference papers on clean steels. For individual papers see N71-31902 to N71-31923. ESRO

N71-31902# Metallurgical Research Plant, Lulea (Sweden).
TECHNIQUES FOR OBTAINING EXTREMELY LOW CONTENTS OF SULPHUR IN STEEL UNDER OXIDIZING AND DEDUCING CONDITIONS
B. Oehman and S. Santen *In* Roy. Swed. Acad. of Eng. Sci. Clean Steel, Vol. 1 1971 p 7–19 refs Sponsored by Swed. Board for Tech. Develop. (See N71-31901 19-17)
Avail: NTIS

This paper is made up of two parts both describing desulfurization techniques. In the first part experiments carried out in a 700 kg ladle furnace for finding and developing a desulfurizing method than can be directly transferred to a full scale production plant are described. In the experiments alloys containing elements with an affinity for sulfur were injected into a steel bath under the slag. Results were favorable. The second part describes gas phase desulfurizing in the KALDO process. It is concluded that oxygen partial pressure improves sulfur removal in the gas phase and that a liquid slag is necessary. ESRO

N71-31904# Domnarvets Jernverk, Borlaenge (Sweden).
STUDIES OF CHANGES IN OXYGEN CONTENT DURING ASEA-SKF TREATMENT
R. Olsson *In* Roy. Swed. Acad. of Eng. Sci. Clean Steel, Vol. 1 1971 p 29–34 (See N71-31901 19-17)
Avail: NTIS

The removal of products from steel after the addition of a deoxidizer is of great importance for the cleanness of the product. The separation of the slag inclusions is influenced by the type of deoxidizer as well as by the motion of the steel bath. The stirring power influence on the oxygen content during ASEA-SKF treatment after deoxidation with silicon, manganese, and aluminum in combination is investigated. The experiments were carried out in a 30 ton ASEA-SKF furnace with induction stirrer. The furnace was lined with neutral bricks Al_2O_3 approximately 75%, except for one heat when a neutral lining with a basic slag line was used for comparison. The aluminum addition was made either before tapping into the furnace giving an initial oxygen content of about from 40 to 70 ppm or after a short heating period in the furnace. For these heats the oxygen content was about 100 ppm before the addition. Author (ESRO)

N71-31905# Swedish Inst. for Metal Research, Stockholm (Sweden).
THE INFLUENCE OF PURITY ON CREEP PROPERTIES OF STEEL
L. Rohlin *In* Roy. Swed. Acad. of Eng. Sci. Clean Steel, Vol. 1 1971 p 35–37 refs (See N71-31901 19-17) Avail: NTIS

A literature survey is made of relations between quantity and creep properties of steels. The effect of nitrogen on the creep properties of pure iron or ferritic steels is studied and also the influence of interstitials such as carbon, nitrogen, or boron, on the creep properties of austenitic steels. Since the creep rupture and deformation properties may be influenced in different ways, the rupture and deformation properties are treated separately for the two steels. ESRO

N71-31906# Sandvikens Jernwerks, A. B. (Sweden).
THE INFLUENCE OF BORON ON THE CREEP PROPERTIES OF AUSTENITIC STAINLESS STEELS
M. Lagerquist and R. Lacgneborg (Roy. Inst. of Tech., Stockholm) *In* Roy. Swed. Acad. of Eng. Sci. Clean Steel, Vol. 1 1971 p 38–53 refs Sponsored by Swed. Board for Tech. Develop. (See N71-31901 19-17)
Avail: NTIS

It has been shown that boron addition has a strong influence on the precipitation of M23C6 in austenitic stainless steels during creep at 700 C. In a boron bearing 20% Cr 35% Ni alloy M23C6 forms intragranularly both as a preferential precipitation on dislocations and as a general precipitation. Owing to a depletion of boron and carbon caused by M23C6-precipitation in the grain boundaries the subsequent general precipitation did not occur in a region adjacent to the grain boundaries and precipitation-depleted zones were created. One effect of the boron was that it reduced the creep rate through the action of the finely dispersed M23C6-precipitation. Measurements of grain boundary sliding on various stainless steels with and without boron showed that the variation in grain boundary sliding could not account for the variation of creep ductility between these materials. It was concluded that boron affects the creep rupture properties by a factor yet unknown. Author (ESRO)

N71-31907# Royal Inst. of Tech., Stockholm (Sweden).
REMOVAL OF NON-METALLIC INCLUSIONS IN THE ESR PROCESS
O. Jarleborg *In* Roy. Swed. Acad. of Eng. Sci. Clean Steel, Vol. 1 1971 p 54–57 refs (See N71-31901 19-17)
Avail: NTIS

The assumption that non-metallic inclusions in stainless steels will disappear during electroslag refining (ESR) is examined. The ESR process is described and reasons for dissolving the inclusions are given. It is concluded that the removal takes place mainly at the electrode tip. ESRO

N71-31910# Royal Inst. of Tech., Stockholm (Sweden).
THE KINETICS OF VACUUM-DEGASSING OF STEEL IN CRUCIBLES MADE OF HIGHLY BASIC REFRACTORY MATERIAL
K. E. Oeberg *In* Roy. Swed. Acad. of Eng. Sci. Clean Steel, Vol. 1 1971 p 82–87 (See N71-31901 19-17)
Avail: NTIS

The oxygen-concentration in steel during vacuum-degassing is controlled by the interaction between the true speed of the two reactions surface-desorption with the formula C + O yields CO sub g and the crucible-erosion MgO yields Mg + O. After a short initial period there will be a dynamic equilibrium between the two reactions and the oxygen-concentration in the bulk is constant. The diffusion of oxygen across boundary-layers controls the true speed of the reactions, but as soon as practically all carbon has been consumed diffusion of carbon will control and reduce the speed of the surface-desorption. When this happens the oxygen-concentration will shortly increase to saturation. Author (ESRO)

N71-31911# Surahammars Bruks A. B., (Sweden). Ferrous Metallurgy Dept.
THE DEOXIDATION OF IRON STUDIED BY EMF MEASUREMENTS AND THE REMOVAL OF THE INCLUSIONS FORMED

K. Torssell *In* Roy. Swed. Acad. of Eng. Sci. Clean Steel, Vol. 1 1971 p 88–99 refs (See N71-31901 19-17)
Avail: NTIS

The results reported give a general picture of the deoxidation of liquid iron with silicon and aluminum. The mechanisms of nucleation and the precipitation of the deoxidation seem to be rather alike for the two elements, while the mechanisms of removal are very different; in the case of silicon-deoxidation, coalescence and rapid removal of glassy silica, in the case of aluminum-deoxidation, formation of clusters consisting of solid alumina particles and their removal due to their big sizes. Author (ESRO)

N71-31912# Royal Inst. of Tech., Stockholm (Sweden).
THE REMOVAL OF INCLUSIONS PRODUCED AS A RESULT OF MANGANESE, SILICON AND ALUMINIUM COMPLEX DEOXIDATION OF IRON
J. Andersson *In* Roy. Swed. Acad. of Eng. Sci. Clean Steel, Vol. 1 1971 p 100–110 refs (See N71-31901 19-17)
Avail: NTIS

Laboratory scale experiments are described in which the rate of removal of inclusions from iron as a result of manganese, silicon, and aluminum complex deoxidation, has been measured. ESRO

N71-31913# Aktiebolaget Atomenergi, Studsvik (Sweden).
THE DUCTILE-BRITTLE TRANSITION IN BODY CENTERED CUBIC METALS
R. B. Roy and B. Solly *In* Roy. Swed. Acad. of Eng. Sci. Clean Steel, Vol. 1 1971 p 111–119 refs (See N71-31901 19-17)
Avail: NTIS

An investigation is made of the role that the lattice itself plays in the ductile-brittle behavior in body-centered cubic metals. Preliminary experiments (tensile testing and optical metallography) comparing polycrystalline specimens of purified and unpurified iron are described. ESRO

N71-31914# Swedish Inst. for Metal Research, Stockholm (Sweden).
SOME ASPECTS OF THE SOLIDIFICATION OF INGOTS
L. Baeckerud *In* Roy. Swed. Acad. of Eng. Sci. Clean Steel, Vol. 1 1971 p 120–129 (See N71-31901 19-17)
Avail: NTIS

A study is made of the solidification process of ingots in view of examining how defects are caused and how they can be avoided. Among the aspects considered are nucleation, crystal growth, ingot structure, and segregations. ESRO

N71-31916# Sandvikens Jernwerks, A. B. (Sweden).
THE INFLUENCE OF SULPHUR ON THE STRUCTURE AND WELDABILITY OF A TITANIUM-BEARING AUSTENITIC STAINLESS STEEL
N. G. Persson *In* Roy. Swed. Acad. of Eng. Sci. Clean Steel, Vol. 1 1971 p 142–151 refs (See N71-31901 19-17)
Avail: NTIS

It is known that sulfur may have a marked influence on the structure and properties, particularly weldability, of steels. Results are presented showing that the sulfur content of titanium-bearing austenitic stainless steels may reduce the strength of the gain boundaries in the heat affected zone adjoining a weld, causing microcracking or hot tearing. ESRO

N71-31917# Swedish Inst. for Metal Research, Stockholm (Sweden).
CORROSION AROUND SLAG INCLUSIONS IN STEEL
G. Eklund *In* Roy. Swed. Acad. of Eng. Sci. Clean Steel, Vol. 1 1971 p 152–158 refs Sponsored by Stora Kopparsbergs Bergslags AB and Graenges-Oxeloesunds Jaernverk (See N71-31901 19-17)
Avail: NTIS

An investigation has been made of the corrosion of polished carbon steels. It was considered that the corrosion started around slag inclusions and it was found that the manganese sulfides had no effects on the initial corrosion. ESRO

N71-31918# Sandvikens Jernwerks, A. B. (Sweden).
INFLUENCE OF INCLUSIONS ON MECHANICAL PROPERTIES OF STEEL: CRITICAL INCLUSION SIZE
R. Kiessling and H. Nordberg (Swed. Inst. for Metal Res.) *In* Roy. Swed. Acad. of Eng. Sci. Clean Steel, Vol. 1 1971 p 159–169 refs (See N71-31901 19-17)
Avail: NTIS

The influence of inclusions on the mechanical properties of steel is considered. Among the aspects considered are classification of inclusions and critical inclusion size related to stress concentrations, cavities, and surface cracks. ESRO

N71-31920# Aktiebolaget Bofors, (Sweden).
THE IMPORTANCE OF SULPHUR IN STEEL IN RELATION TO MECHANICAL PROPERTIES
S. Arwidson *In* Roy. Swed. Acad. of Eng. Sci. Clean Steel. Vol. 1 1971 p 178–185 (See N71-31901 19-17)
Avail: NTIS

Tests were carried out on desulfurized hardened and tempered, and high strength constructional steels, stainless and carbon steels for investigating their mechanical properties in the transverse and longitudinal directions as function of sulfur content. It is shown that extremely low sulfur content improves impact and tensile strength of steel, especially in the transverse direction. ESRO

N71-31921# Uddeholms A. B., Hagfors (Sweden).
THE INFLUENCE OF NITROGEN ON HOT WORKABILITY OF AUSTENITIC STAINLESS STEEL
B. Janzon and A. Omsen *In* Roy. Swed. Acad. of Eng. Sci. Clean Steel, Vol. 1 1971 p 186–200 refs (See N71-31901 19-17)
Avail: NTIS

The influence of nitrogen in the range from 0% to 0.2% on the hot ductility of molybdenum-alloyed austenitic stainless steel has been investigated. Nitrogen has a positive influence on hot ductility up to a certain content where it becomes a negative one. This transition content has been found to be in the range from 0.08% to 0.20% nitrogen depending on nickel content and temperature. Author (ESRO)

N71-31922# Sandvikens Jernwerks, A. B. (Sweden).
THE INFLUENCE OF NITROGEN AND SULPHUR ON THE HOT WORKABILITY OF AUSTENITIC STAINLESS STEEL
R. Johansson *In* Roy Swed. Acad. of Eng. Sci. Clean Steel, Vol. 1 1971 p 201–216 refs (See N71-31901 19-17)
Avail: NTIS

The influence of nitrogen and sulfur on ductility, flow stress and recrystallization in cast structure of 316-L-type steel has been investigated. Hot ductility and flow stress were studied by hot tensile testing. The recrystallization studies were performed after hot rolling at 900, 1025, and 1150 C. Nitrogen decreases ductility and recrystallization rate and increases the flow stress. The decrease in ductility may be explained by the solution hardening of the matrix and the evidence that carbon and nitrogen diffuse to the dendritic areas during heat treatment. This will lead to a heavier deformation of grain boundary areas and cause an earlier intergranular rupture. The

decrease in recrystallization rate is possibly due to the fact that dissolved nitrogen impedes dislocation glide. The high sulfur material has a ductility level between the two other materials and the highest recrystallization rate. This behavior is caused by heavy local deformation due to grain boundary hooking by sulfides. Author (ESRO)

N71-31923# Royal Inst. of Tech., Stockholm (Sweden). Ferrous Metallurgy Dept.

BEHAVIOUR OF SLAG INCLUSIONS OF DIFFERENT COMPOSITION DURING HOT WORKING CONDITIONS

S. Ekerot *In* Roy. Swed. Acad. of Eng. Sci. Clean Steel, Vol. 1 1971 p 217-228 refs Sponsored by Swed. Board for Tech. Develop. (See N71-31901 19-17)

Avail: CFSTI

The behavior of nonmetallic inclusions in steel during hot deformation of the steel was studied. Slag inclusions in the system FeO-MnO-SiO2, Al2O3 were studied during plane compression tests. The deformation ratios of the inclusions were measured and expressed in terms of the index of deformation, which is the ratio of true elongation of inclusion and the true elongation of the steel. The most important variables are the composition of the inclusions and the working temperature, but attention is also paid to the size and morphology of inclusion, steel hardness, strain rate, and deformation ratio for the steel specimen. For silicates a very narrow transition temperature range is reported below which the inclusion behaves rigidly and over which it behaves in a fluid manner. For FeO-MnO-oxide no transition temperature exists. They have an index of deformation of 0.5 over a wide temperature range. Cracks and cavities exist around the inclusions. Author (ESRO)

N71-31925# Akademiya Nauk URSR, Kharkov. Fiziko-Tekhnicheskii Inst.

DIMENSIONAL EFFECT IN MAGNETIZATION OF STRONG SUPERCONDUCTORS

B. G. Lazarev and O. N. Ovcharenko 1970 11 p refs In RUSSIAN

(KHFTI-70-8) Avail: AEC Depository Libraries

Behavior of magnetized Nb-Zr-Ti, Nb-Ti, and Nb-Zr alloys as a function of the structure of the alloys was studied. In the cast state, or in a single phase, the magnetization depended only slightly on the magnetic field strength, but was strongly influenced by the dimension (diameter) of the specimen. The same effect held for a homogeneous superconductor and deformed alloys. In two-phase alloys, deformed and heat treated, the magnetization curve varied strongly with reduced diameter of the cylindrically shaped specimens. Author (NSA)

N71-31966# Carnegie-Mellon Univ., Pittsburgh, Pa. Metals Research Lab.

GRAIN BOUNDARY SEGREGATION OF IMPURITIES IN METALS AND INTERGRANULAR BRITTLE FRACTURE

John R. Low, Jr. and Craig L. Smith May 1971 41 p refs

(Contract N00014-67-A-0314-0002)

(AD-723224; CMU-031-727-3) Avail: NTIS CSCL 11/6

Temper embrittlement in low alloy steels was studied by examining changes in the composition of prior austenitic grain boundaries resulting from embrittling treatments performed on an Sb doped 3340 steel. Neutron activation analysis was used to chemically analyse etchant residues obtained from intercrystalline fracture surfaces. Antimony was shown to segregate to the grain boundaries during embrittling while the concentration of nickel in ferritic portions of the boundaries decreased. Embrittlement treatments produced no detectable changes in the chromium content of the boundaries. Author (GRA)

N71-32023# United Aircraft Corp., East Hartford, Conn. Research Labs.

EFFECT OF VANADIUM AND SODIUM COMPOUNDS ON ACCELERATED OXIDATION OF NICKEL-BASE ALLOYS Annual Report, 1 Mar. 1970-28 Feb. 1971

Norman S. Bornstein, Michael A. DeCrescente, and Hilton A. Roth Mar. 1971 70 p refs

(Contract N00014-70-C-0234)

(AD-723207; UARL-K910983-2) Avail: NTIS CSCL 11/6

The conditions necessary for condensation of V2O5 and alkali vanadates has been determined. The effect of V2O5 on the oxidation kinetics of nickel-base alloys has been examined and the oxidation behavior of V2O5-Na2SO4 coated nickel-base alloys were studied. Based upon thermogravimetric and electrochemical studies, it was found that the accelerated rate of oxidation of the salt-coated superalloys is related to the oxide ion concentration of the melt. Author (GRA)

N71-32112# Bhabha Atomic Research Centre, Bombay (India). Metallurgy Div.

TRANSMISSION ELECTRON MICROSCOPIC STUDIES OF COLD-ROLLED ZIRCONIUM

P. Mukhopadhyay, S. Banerjee, and R. Krishnan [1970] 17 p refs

(INIS-mf-15) Avail: AEC Depository Libraries

A study of the room temperature deformed structure by cold rolling of crystal bar zirconium is reported. It was observed that apart from the expected increase in the dislocation density, the nature of the dislocation configuration changed with increasing degrees of cold work. Slip trace and selected area diffraction analyses showed that though slip occurred pre-ponderantly on prismatic planes, pyramidal glide was also operative. The samples rolled at low degree of reductions per pass appeared to deform only by slip, whereas both slip and twinning were seen to be the deformation modes when the reduction per pass was greater. The presence of hydride precipitates with the associated dislocations and the interaction of dislocations with these precipitates were observed. Author (NSA)

N71-32125# Battelle Memorial Inst., Columbus, Ohio.

NMR LINEWIDTHS IN METALS AS A FUNCTION OF TEMPERATURE Annual Technical Report, 22 May 1970-21 May 1971

J. I. Kaplan 27 May 1971 17 p refs

(Contract N00014-69-C-0218)

(AD-723914) Avail: NTIS CSCL 20/12

A density matrix equation is derived which permits the temperature dependence of the nuclear magnetic linewidth in metals to be obtained. Contributing to the linewidth are dipolar and exchange interactions, spin lattice relaxation times, and vacancy diffusion. Author (GRA)

N71-32143*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CREEP-RUPTURE TESTS OF INTERNALLY PRESSURIZED HAYNES ALLOY NO. 25 TUBES

Klaus H. Gumto Washington Aug. 1971 28 p refs

(NASA-TM-X-2346; E-6078) Avail: NTIS CSCL 11F

Two heats of Haynes Alloy No. 25 wall tubes 0.953 cm o.d. by 0.064 cm were tested to failure at temperatures from 1089 to 1200 K and internal helium pressures from 4.1 to 12.4 MN/sq m. Lifetimes ranged from 385 to 4609 hr for one heat, whose creep rupture strength correlated with that of sheet tensile specimens. The other heat, with lifetimes from 144 to 1308 hr, had strengths 20 to 40 percent lower. Larson-Miller parameter correlations and photomicrographs of some specimens are presented. Author

N71-32161*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LINING METAL TUBES BY CREEP FORMING
William L. Masg and William F. Mattson Washington Aug. 1971 14 p refs
(NASA-TM-X-2347; E-6365) Avail: NTIS CSCL 11F

A method of forming and bonding a metallic lining onto the inside surface of a metal tube is described and examples are given. The method uses the biaxial creep of an internally pressurized thin-wall tube as a means of applying force at high temperature to several layers of a thin metallic foil sandwiched between the inner tube and an outer metal tube. After bonding, the inner tube material is removed by either chemical or mechanical means. Author

N71-32162*# General Electric Co., Cincinnati, Ohio. Space Systems.
DETERMINATION OF BIAXIAL CREEP STRENGTH OF T-111 TANTALUM ALLOY
G. P. Brandenburg and L. B. Engel, Jr. Aug. 1971 179 p refs
(Contract NAS3-9437)
(NASA-CR-72846; GESP-647) Avail: NTIS CSCL 11F

One seamless and one welded and reworked biaxial creep test capsules of T-111 alloy tubing were tested at 2200 F for 5000 hours each in a high vacuum environment. The sealed capsules were half filled with liquid potassium. The stress in the thin wall gage sections were generated by the potassium vapor pressure generated within the refluxing capsule. Diametral measurements were made in the thin wall gage sections during the uninterrupted test and were subsequently converted to equivalent uniaxial creep values. The creep data obtained was then compared with the results of a standard uniaxial creep test conducted on the same material at the same temperature, time, and stress level. The agreement between the biaxial creep results and the uniaxial creep results in the 1% to 2% creep range was found to be good and the creep results were also found to agree with previously reported uniaxial creep data for T-111 alloy. Author

N71-32183 National Lending Library for Science and Technology Boston Spa (England).
STUDY OF CONDITIONS OF ELECTRODEPOSITION OF ALLOYS OF THALLIUM WITH NICKEL AND COBALT AND A TERNARY ALLOY OF NICKEL, THALLIUM AND COBALT BY USING THE RADIOACTIVE INDICATORS THALLIUM 204 AND COBALT 60
G. R. Pobedimskii 3 Nov. 1970 9 p refs Transl. into ENGLISH from Tr. Kazansk. Khim.-Tekhnol. Inst. (Kazan), no. 29, 1960 p 82–86
(NLL-LTI-746-621-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A new method for studying conditions of formation of electrodeposits using radioactive isotopes as indicators is described and results reported for electrodeposition of thallium alloys with nickel and cobalt and of a ternary alloy of nickel, thallium, and cobalt. Thallium 204 and cobalt 60 were used as indicators. Specific attention was paid to the dependence of alloy composition on cathodic current density and on electrolyte temperature. Tests showed that joint electrodeposition of nickel with thallium and of thallium with cobalt produced lustrous deposits, 8 to 10 microns in thickness, and with a cathodic efficiency of nearly 100%. Successful application of the method of ternary alloy system was also achieved. A.C.R.

N71-32228# Stanford Univ., Calif.
APPLICATION OF CONTROLLED ELECTROMAGNETIC FORCES DURING SOLIDIFICATION OF TYPE 304 STAINLESS STEEL Quarterly Report, 1 Dec. 1969–1 Mar. 1970
William A. Tiller 1970 6 p
(Contract AT(04-3)-326)
(SU-326-P-29-X-1) Avail: NTIS

An investigation into the effects of applying controlled electromagnetic forces to Type-304 stainless steel melts during solidification is discussed. Grain refinement, undercooling, large magnetic coil construction and testing, metallographic studies, and problem areas are summarized. J.M

N71-32234*# Translation Consultants, Ltd., Arlington, Va.
SHORT-TERM CREEP OF NICKEL IN A HIGH-SPEED AIR FLOW [KRATKOVREMENNAYA POLZUCHEST NIKELYA V SKOROSTNOM VOZDUSHNOM POTOKE]
V. G. Sorokin et al Washington NASA Jun. 1971 8 p refs Transl. into ENGLISH from Metalloved. i Term. Obrabotka Metal. (Moscow), no. 3, 1970 p 2–5
(Contract NASw-2038)
(NASA-TT-F-13661) Avail: NTIS CSCL 11F

The short term creep of nickel in a vacuum, in an immobile medium, and in a high speed air flow at temperatures ranging from 700 to 800 degrees C, and loadings ranging from 2 to 4 kg/sq mm is studied. It is found that in stationary air, the steady state creep rate decreases slightly, while in a high speed air flow the creep rate during the second creep stage increases and the time to failure is substantially reduced. The results obtained are explained in terms of the oxidation and corrosion-erosion effects of the high speed air flow. Author

N71-32235# National Bureau of Standards, Washington, D.C.
MOLECULAR DYNAMICAL STUDIES OF THE PHASE TRANSFORMATION OF IRON UNDER PRESSURE
D. H. Tsai and R. A. MacDonald 11 Mar. 1971 36 p refs
(Contract AT(49-16)-3003)
(TID-25683) Avail: NTIS

Molecular dynamics was applied to the study of the transformation of iron from the alpha phase (bcc) to the epsilon phase (hcp) under hydrostatic pressure. The atomic interaction energy in both phases was represented by a two body, central-force potential fitted to (1) the elastic properties of the alpha phase at zero pressure and zero absolute temperature, and (2) an assumed transition pressure of 130 kb at zero absolute temperature, with a volume decrease of 0.2 cu cm/mol upon transition from the alpha to the epsilon phase. The classical equations of motion of the lattice points were solved by numerical computation, and the equation of state and specific heat data were obtained from the appropriate time averages of the dynamical solutions. From these quantities, the Gibbs free energies of the two phases were calculated and a phase diagram for the alpha to epsilon transition was constructed. It was found that the phase diagram thus obtained was in satisfactory agreement with experimental results. By observing the details of the lattice point motion given by the dynamical solutions, it was possible to follow the process of phase transformation when it occurred in the model. A martensitic type of buckling mechanism which was observed to transform the alpha phase to the epsilon phase was described. Author

N71-32242*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ENERGY DEPENDENCE OF ELECTRON INDUCED RADIATION DAMAGE IN TUNGSTEN
James A. DiCarlo and James T. Stanley Washington Aug. 1971 27 p refs
(NASA-TN-D-6484; E-6330) Avail: NTIS CSCL 11F

The onset and low dose effective threshold energies for the 350 K production of electron-induced damage in tungsten were determined to be 50 + or − 2 eV and 52 + or − 2 eV, respectively (electron energy = 1.62 MeV). These results when combined with bcc damage theory and other experimental data

suggest that (1) the 350 K thresholds should hold from 100 to 600 K, (2) the minimum recoil energy required for free interstitial production near 0 K is 53 + or − 5 eV, (3) threshold in tungsten has little dependence on crystal direction, and (4) threshold in any bcc transition metal can be estimated by assuming a direct proportionality with Young's modulus. Author

N71-32285# Royal Aircraft Establishment, Farnborough (England).
THE INFORMATION CONTENT OF FLOW CURVES [ZUM INFORMATIONSGEHALT VON FLIESSKURVENKENNGROESSEN]
Gottfried Pysz Nov. 1970 25 p refs Transl. into ENGLISH from Neue Huette (Berlin), v. 13, no. 4, 1968 p 240–247
(RAE-Lib-Trans-1523) Avail: NTIS

Investigations were carried out to examine the information content of the flow curve parameters a and n. It was shown, by means of experimental results, how the flow curve is influenced by heat treatment aging and heterogeneity. Relationships were derived between the flow curve parameters and mechanical property data such as 0.2% proof stress, tensile strength, deep drawing capacity and fatigue strength which allow these parameters to be calculated from values of a and n. Finally, a comparison is made between tensile and compression testing. Author

N71-32286# Royal Aircraft Establishment, Farnborough (England).
FLOW CURVES OF POLYCRYSTALLINE METALS AND THEIR APPLICATION TO PLASTICITY MECHANICS [DIE FLIESSKURVEN VIELKRISTALLINER METALLE UND IHRE ANWENDUNG IN DER PLASTIZITAETSMECHANIK]
Hein-Peter Stuewe Dec. 1970 30 p refs Transl. into ENGLISH from Z. Metallk. (Stuttgart), v. 56, 1965 p 633–642
(RAE-LIB-Trans-1531) Avail: NTIS

A general discussion is given of the flow curves observed in metals and the methods used for measuring these curves. At very high degrees of deformation, the curves show effects which are not yet explained. This is true both at room and at elevated temperatures. The anisotropy of deformed metals, due to texture and dislocation structure, make it difficult to compare flow curves determined by different techniques. Therefore the use of flow curves in plasticity mechanics calculations will generally lead to small errors. Empirical factors are presented which allow these errors to be corrected. The final portion of the flow curve leading to test piece fracture is discussed and it is concluded that the torsion test tends to give the best indication of ductility. Author

N71-32300 National Lending Library for Science and Technology, Boston Spa (England).
PROPERTIES AND STRUCTURE OF LOW-CARBON CHROMIUM-NICKEL IRON ALLOYS, ALLOYED WITH TITANIUM
F. L. Levin et al 3 Nov. 1970 20 p Transl. into ENGLISH from Metalloved. i Term. Obrabotka Metal. (USSR), no. 5, 1970 p 15–19 In ENGLISH and RUSSIAN
(NLL-LTI-746-668-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

In quenched austenitic chromium-nickel alloys, titanium does not change the mechanical properties in the limits investigated. Stability at room and raised temperatures depends on the carbon content. With an increase of the ratio Ti/C up to 14, the plasticity and impact strength of the metal increases at elevated temperatures; a further increase of the ratio of Ti/C decreases these characteristics. Aging of the alloys is accompanied by precipitation of carbides. The maximum embrittlement and hardening is observed in alloys in which the intermetallic phase Ni3Ti precipitates together with the carbides. Intercrystalline corrosion resistance increases with a decrease of the carbon content in the alloy. Titanium, combining in stable carbides, increases intercrystalline corrosion resistance. Author

N71-32301 National Lending Library for Science and Technology, Boston Spa (England).
EXPERIMENTS ON THE CORROSION BY SODIUM OF STEELS FOR CLADDING FUEL ELEMENTS IN A SODIUM COOLED FAST BREEDER REACTOR
H. U. Borgstedt et al Oct. 1970 16 p refs Transl. into ENGLISH from German report KFK-991
(NLL-Risley-Trans-2015-(9091.9F); KFK-991) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The annual decrease in thickness of sheathing tubes under experimental conditions was calculated from corrosion experiments on high-temperature high-strength austenitic steels in the Cerberus sodium cycle. Obtained values agreed qualitatively with data given in the literature. They show that steels tested in sodium behave in a similar way. After about 5000 hours of penetration by sodium, the interstitial components of the steels did not change their composition measurably. Author

N71-32321*# Martin Marietta Corp., Denver, Colo.
PROPERTIES OF CRYOGENICALLY WORKED MATERIALS Final Report
R. G. Herzog, S. H. Osgood, and D. Lighty Aug. 1971 159 p refs
(Contract NAS3-12028)
(NASA-CR-72798) Avail: NTIS CSCL 11F

Screening tests conducted on 15 alloys indicated that only two, PH 14-8 Mo and MP 35 N, developed significantly higher strengths when strained at cyrogenic temperatures than when strained at room temperature. From additional testing of PH 14-8 Mo it was determined that the material can be cryostrained and aged to higher strengths than those achieved through industry standard treatments. Through combined cryostrain-aging treatments it is possible to strengthen PH 14-8 Mo to obtain yield strength to density ratios in excess of 1,000,000 inches. Although further study is necessary before a final determination can be made the indications are that PH 14-8 Mo cryostrained and aged to above normal strengths will have sufficient toughness and corrosion resistance to be a useful structural material. Author

N71-32322# California Univ., Los Angeles. School of Engineering and Applied Science.
PARTICLE SIZE DISTRIBUTION EFFECTS IN PRECIPITATION HARDENING Annual Progress Report, 1 Apr. 1970–31 Jan. 1971
A. J. Ardell Feb. 1971 31 p refs
(Contract AT(04-3)-34)
(UCLA-34-P-172-1; APR-2) Avail: NTIS

A theoretical modification of the Lifshitz–Slyozov theory of particle coarsening was developed for the purpose of estimating the effect of volume fraction on the coarsening rates. The modified theory accounts satisfactorily for the literature data on coarsening rates and interfacial free energies in the Cu-Co system. For the modified theory, a calculation of the average center-to-center distance between near-neighbor precipitates is necessary. This problem was also solved to a high level of approximation. Experiments were performed on Ni-Cr-Al and Ni-Al alloys containing high volume fractions of gamma prime. The gamma prime coarsening rates in Ni-Cr-Al show the type of volume fraction effect predicted by the theory, but in Ni-Al alloys gamma prime coarsens at the same rate, independent of volume fraction over the 9–60% range. It is suggested that this is due to the relatively large gamma/gamma prime lattice mismatch in the binary alloy. The completion of a programmable aging furnace and the development of a computer program for matching a specific two-parameter distribution with experimental data obtained from particle size measurements are discussed. Author

N71-32378 Iowa Univ., Iowa City.
THE LOW TEMPERATURE ELECTRICAL RESISTIVITY OF

COPPER-ALUMINUM ALLOYS WHICH CONTAIN TRACE AMOUNTS OF IRON
Paul F. Tumelty (Ph.D. Thesis) 1970 171 p
Avail: Univ. Microfilms Order No. 70-15650

The results of a series of low temperature resistivity measurements on the dilute (Cu-Al)-Fe alloy system are described. Four (Cu-Al)-Fe samples, each having a nominal iron concentration of 0.07 at. %, and having nominal aluminum concentrations of 0, 2.5, 5, and 10 at. % were measured in the temperature range from 2.5 K to 50 K. Each of the four alloys which contain iron exhibit a minimum in the temperature dependence of resistivity. This result is characteristic of a system in which there is a negative exchange interaction between the conduction electrons and the d-shell valence electrons of the magnetic impurity. The temperature at which the minimum occurs decreases slightly as the aluminum content is increased. The results of the resistivity measurements on the four nonmagnetic host samples indicate that the functional dependence of the residual resistivity of the Cu-Al alloys on aluminum concentration may be described by a modification of Nordheim's rule. Dissert. Abstr.

N71-32395# Bureau of Mines, Rolla, Mo. Metallurgy Research Center.
CREEP AND OTHER PROPERTIES OF EXTRUDED ZINC-30 PERCENT ALUMINUM ALLOYS CONTAINING MAGNESIUM
L. A. Neumeier and J. S. Risbeck Jul. 1971 31 p refs
(BM-RI-7538) Avail: NTIS

Creep and other properties of extruded Zn-30 percent Al alloys, containing 0 to 0.7 percent Mg, were evaluated. The alloys were extruded both above and below the Zn-Al eutectoid temperature of 275 C. Creep behavior is defined for the alloys as extruded and after various heat treatments. Tensile properties, hardness, thermal expansivity, impact resistance, and microstructures are given. The alloys, either with or without magnesium, required substantially less pressure for extrusion near 275 C than at higher or lower temperatures. The alloys containing magnesium exhibited significantly greater hardness, tensile strength, and creep resistance, but much lower ductility than the Zn-30 percent Al alloy. The properties were very sensitive to the processing conditions. Author

N71-32423# Bureau of Mines, Albany Oreg. Metallurgy Research Center.
A NEW INTERNAL OXIDATION PROCESS FOR STRENGTHENING TUNGSTEN
Robert Blickensderfer, Mark I. Copeland, and William O'Brien Jun. 1971 44 p refs
(BM-RI-7521) Avail: NTIS

Tungsten alloys with high-temperature strength properties, comparable to the best of alloys recently developed by others, were produced by a new process called here the oxyreaction process. The process involved additions of a powder of a reactive metal compound, ZrN, ZrW2, or HfW2, to a base metal powder, tungsten, which contained some oxygen. The powders were blended, compacted, sintered, and extruded. During sintering, diffusion and internal oxidation occurred to produce reactive-metal oxide particles and solid solutions. A dispersion of oxide particles could be precipitated by heat treating. The oxyreaction process circumvents many of the agglomerating and coarsening problems encountered in the current methods for dispersing a stable oxide in a metal. Author

N71-32431# National Science Foundation, Washington, D.C.
PHASE TRANSFORMATION IN: Cu-Ni-Zn ALLOYS
B. G. Livshits 1970 12 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Chernaya Met. (Moscow), no. 1, 1957 p 123-127
(TT-70-58192; DMDC-6044) Avail: NTIS CSCL 11F

By measuring physical properties it was shown that in numerous single phase systems in which a stereometric proposition of components exists, a certain state and also state K originates as the alloys according to their composition move away from the stereometric proportion. It was suggested that state K in nonstereometric composition alloys is included in the formation of alloys with a removed state and in which the composition changes until it becomes stereometric. To prove this proposition, single phase alloys containing the solid dissolvent and belonging to the system Cu-Ni-Zn, were chosen. Author (GRA)

N71-32450 Pennsylvania Univ., Philadelphia.
A STUDY OF PHASE DECOMPOSITION IN LIQUID-QUENCHED ALUMINUM-SILVER ALLOYS
Raymond Roberge (Ph.D. Thesis) 1969 247 p
Avail: Univ. Microfilms Order No. 70-16202

A novel technique for liquid-quenching, the torsion-catapult, was used in the study. The specimens thus produced were suitable for the study of change in electrical resistance and investigation using small-angle X-ray scattering (SAXS). The decomposition of the liquid-quenched structures was studied kinetically and structurally in the temperature range where results on solid-quenched specimens are available for comparison; i.e., 100 to 200 C. The aging behavior of liquid-quenched specimens using the torsion-catapult was followed with hot-stage electron microscopy, electrical resistance changes, and high-angle X-ray intensity measurements. The behavior is found to be very similar to the well-established behavior of the solid-quenched specimens. The activation energy obtained from X-ray intensity measurements is in good agreement with the estimate for equilibrium diffusion. Dissert. Abstr.

N71-32464# Sandia Corp., Albuquerque, N.Mex. Metallurgy Div.
THE DETERMINATION OF THE ACTIVATION ENERGY FOR THE PRECIPITATION OF Al6Mn IN Al-3.4w/oMn ALLOY
Maurice M. Karnowsky Mar. 1971 44 p refs
(SC-RR-70-356) Avail: NTIS

A supersaturated solid solution of manganese in aluminum was prepared by plasma-spraying the alloyed powder onto a rotating, water-cooled mold. Samples were obtained from the cylinder produced. The isothermal change in resistance with time, at several temperatures, in vacuum-vacuo and air, permitted the calculation of the activation energy for the precipitation of Al6Mn, which was found to be 33,000 + or - 2000 cal/mole in vacuo and essentially the same value in air. The magnitude of the activation energy suggests a cluster to vacancy or complex cluster migration mechanism. In the temperature range 425-500 C, an additional transformation is indicated with an activation energy approximately 18,000 cal/mole + or - 2000. Author

N71-32489*# Rocketdyne, Canoga Park, Calif.
INFLUENCE OF GASEOUS HYDROGEN ON METALS Interim Report
R. J. Walter, H. G. Hayes, and W. T. Chandler 24 May 1971 89 p refs
(Contract NAS8-25579)
(NASA-CR-119917; R-8719) Avail: NTIS CSCL 11F

The gaseous hydrogen environment embrittlement was investigated in Inconel 718, Inconel 625, AISI 321 stainless steel, Ti-5Al-2.5Sn ELI, and OFHC copper. The program was divided into the following phases: (1) Tensile tests on notched specimens were used to determine the effect of as-received material condition, heat treatment, and welding on the hydrogen environment embrittlement of Inconel 718 in 5000 psi hydrogen at room temperature. (2) The effect of 5000 psi hydrogen on the tensile properties of the alloys was determined at room temperature and -200 F. (3) Threshold stress intensities for the alloys listed above and in addition 2219-T87 aluminum alloy were determined with modified WOL specimens for a hydrogen pressure of 5000 psi and room temperature. Author

N71-32515 Washington State Univ., Pullman.
STEADY STATE CREEP OF ALPHA ZIRCONIUM
Edgar Robert Gilbert (Ph.D. Thesis) 1970 77 p
Avail: Univ. Microfilms Order No. 70-16783

The uniaxial tensile creep behavior of zirconium was investigated through the range of temperatures corresponding to the beta-to-alpha transformation to 50 C. Three materials were employed in the investigation: commercially pure zirconium annealed in the stable beta-phase region, commercially pure zirconium annealed in the stable alpha-phase region, and iodide zirconium annealed in the stable alpha-phase region. Dissert. Abstr.

N71-32539 Pennsylvania Univ., Philadelphia.
THE GENERATION AND ANNEALING OF IMPERFECTIONS IN BETA-CuZn ALLOY
Michael Julius Koczak (Ph.D. Thesis) 1969 131 p
Avail: Univ. Microfilms Order No. 70-16176

To clarify the ordering process utilizing electrical resistivity measurements, a study was initiated to reveal the defects associated with quenching, plastic deformation, neutron and electron irradiation, and their effects on the order-disorder transformation. Enhanced ordering of beta-brass was achieved by annealing of single vacancies subsequent to electron irradiation. Disorder was introduced and recovered by both quenching and plastic deformation. A change in the quenching rate was shown to affect the recovery process by possibly altering the sink concentration. No changes were observed in neutron irradiated beta-brass due to the low neutron dose coupled with a high irradiation temperature. Several defect mechanisms were identified in beta-brass. Interstitial motion was ascribed to defect motion below 100 K. Single vacancy motion was believed to be responsible for enhanced ordering following electron irradiation. Ordering following quenching was believed to occur by a vacancy mechanism, with the divacancy as a possible ordering defect. Dissert. Abstr.

N71-32548 Maryland Univ., College Park.
INVESTIGATION OF THE RESIDUAL DEFECT IN INDIUM ANTIMONIDE
John Lytle Scales, III (Ph.D. Thesis) 1969 118 p
Avail: Univ. Microfilms Order No. 70-16030

An interaction was observed between lithium and the residual donor in indium antimonide. Measurements of Hall coefficient, resistivity, PEM lifetime, and PC lifetime were made on p-type specimens of indium antimonide in the temperature range from 50 to 300 K. Some specimens were treated by diffusing lithium at 240 C, and allowing the excess lithium to precipitate at room temperature. The treated and untreated specimens differed in the following ways: (1) The electron lifetime at 77 K was 10 to the minus 12th power s in untreated specimens and 10 to the minus 8th power s in treated specimens. (2) Carrier freeze-out, occurring at temperatures in the range from 50 to 100 K, was observed in the untreated material and not in the treated material. (3) The low temperature hole mobility of the untreated specimens reached a maximum and decreased as the temperature was lowered further, while the mobility of the treated specimens continued to increase at low temperatures. Dissert. Abstr.

N71-32549 Pennsylvania Univ., Philadelphia.
THE AGING BEHAVIOR OF CO-DEPOSITED ALLOY THIN FILMS
Brian Philip Sack (Ph.D. Thesis) 1969 82 p
Avail: Univ. Microfilms Order No. 70-16206

Co-deposited alloy thin films of Al, Al-6.6 at.%Ag, Al-14.6 at.%Ag and Al-2.0 at.%Cu, alloys in which the aging properties have been thoroughly investigated in bulk systems, have been studied in order to: (1) determine the nature of random solid solution decomposition of an alloy system which exhibits G.P. zone formation in the bulk, (2) investigate the role of the surface in its influence upon the decomposition by providing a vacancy sink, (3) determine the role of defects in thin film solid solution decomposition, and (4) examine the structure of the thin films and its effect upon the decomposition. The films were formed under high vacuum by simultaneously evaporating each component independently, alloying in the vapor, and depositing upon a glass substrate at 80 K. The films were then aged isochronally in vacuo, or aged isothermally in a conventional bath outside of the vacuum system. Resistivity measurements were used to follow the decomposition process. Dissert. Abstr.

N71-32557# British Steel Corp., London (England). Corporate Labs.
MASS TRANSFER BETWEEN LIQUIDS AND DROPS OR BUBBLES
M. W. Davies and J. Alexander 17 Nov. 1970 24 p refs Presented at Intern. Symp. on Met. Kinetics in Steelmaking, Aachen (PB-198-365; BISRA-CH/50/70) Avail: NTIS CSCL 11F

Theoretical aspects of mass transfer between continuous liquid phases and liquid drops or gas bubbles are reviewed, with particular reference to the kinetics of steelmaking processes. The behaviour of metal droplets falling through continuous slag phases is interpreted by reference to theoretical and empirical mass transfer equations, and the agreement between theory and practice commented upon. Similarly the formation, detachment and growth during rise, of gas bubbles in liquid metal systems are described by means of theoretical mass transfer equations, and again the agreement between theory and practice commented upon. Only single species have been considered, but it is observed that the nteraction between multiple drops and bubbles must be taken into account before mass transfer in steelmaking systems can be fully quantified. Author (GRA)

N71-32579 Rutgers Univ., New Brunswick, N.J.
SUPERCONDUCTIVITY IN SILVER
Stuart Alan Wolf (Ph.D. Thesis) 1970 124 p
Avail: Univ. Microfilms Order No. 70-16962

Thermal conductivity and critical field measurements were made on triple layer films consisting of two outer layers of a PbBi alloy and an inner layer of silver. Superconductivity is induced in the silver and disappears at a magnetic field sufficiently low that the conductivity of the PbBi layers is the same as in zero field. K(S)/K(N) for the silver layer can therefore be measured directly and from its temperature dependence information on the excitation spectrum in the silver can be obtained. The results indicate a complex spectrum which was approximated by assuming the existence of two gaps. The measurements of critical field as a function of temperature show that supercooling appears below a temperature T^* and that the supercooling field is proportional to temperature down to a temperature T(s) below which it stays constant. These results indicate that between T(s) and T^* the field transition is of first order and is very well described by a temperature dependent K. Dissert. Abstr.

N71-32586 National Lending Library for Science and Technology, Boston Spa (England).
EFFECT OF CARBON ON THE HIGH TEMPERATURE PROPERTIES OF TYPES 304 AND 316 AUSTENITIC STEELS.
Heitaro Yoshida, et al 15 Dec. 1970 27 p refs Transl. into ENGLISH from Tetsu to Hagane (Japan), v. 56, 1970 p 311-330 (NLL-RISLEY-Trans-2039-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Carbon effects on the high temperature properties of Types 304 and 316 stainless are summarized. Carbon solid solubility limits, deformation resistance, age hardening properties and structures, anti-softening properties and creep rupture characteristics are included. J.M.

N71-32597# Atomic Energy Commission, Washington, D.C.
INTERACTION OF BORON AND CARBIDE WITH AUSTENIC CHROME-NICKEL STEEL IN A MEDIUM OF SODIUM
V. P. Smirnov et al [1971] 21 p Transl. into ENGLISH from Russian report FEI-119
(AEC-tr-7183) Avail: NTIS

The interactions of boron carbides with steel were investigated with the following results. Boron carbide does not react with austenitic chrome–nickel steel upon immediate contact and in the presence of an air gap at temperatures to 880 C and time duration to 5000 hr. Given a sodium layer between the boron carbide and steel, a reaction occurs which forms the borides Me2B, (Cr,Ni,Mo)yB3, or (Cr,Ni,Mo)5B, Me4B3 or Me5B4, or Me-Mo, Cr, Ni, Fe. The formation of borides results in the redistribution of steel components expressed by reduced iron and nickel concentrations and an increase in the chromium concentration at the boundary of the boride phase in the steel. Author (NSA)

N71-32640# Indian Inst. of Science, Bangalore. Dept. of Metallurgy.
KINETICS OF THE HIGH-TEMPERATURE OXIDATION OF DISPERSION-STRENGTHENED NICKEL-NIOBIA ALLOYS
T. H. Rao and K. I. Vasu 1970 46 p refs Presented at Symp. on Mater. Sci. Res., Bangalore, India, 24 Feb. 1970
(INIS-mf-11; Conf-700218-13) Avail: AEC Depository Libraries

The results are presented on the oxidation of nickel-niobium alloys containing 1 to 5 vol % Nb2O5, carried out in oxygen in the temperature range of 700 to 950 C. The conclusions reached are: (1) In this temperature range, sintered nickel undergoes a two-stage oxidation (logarithmic followed by parabolic) while there are three stages of oxidation in nickel-niobium alloys. (2) Nickel-niobium alloys are inferior to pure nickel in their oxidation resistance, and the effect of Nb2O5 in nickel is nearly the same as that due to Nb in Ni. (3) The logarithmic and linear stages of oxidation of nickel-niobium alloys represent a phase-boundary process. (4) The parabolic kinetics represent a diffusion process, identified as the outward diffusion of Ni(2+) ion across the oxide scale. F.O.S.

N71-32656 National Lending Library for Science and Technology, Boston Spa (England).
NEW STUDIES OF THE ISOTHERMAL CORROSION OF INCOLOY 800 BY SUPERHEATED STEAM
Siegfried Leistikow (Kernforschungszentrum, Karlsruhe (West Ger.) 8 Mar. 1971 5 p Transl. into ENGLISH from the German report Presented at the Deut. Ges. Metallk. Conf. on Gases in Metals, Darmstadt, Mar. 1970
(NLL-Risley-Trans-2093-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

In order to select materials suitable for exposure to superheated steam, long term isothermal corrosion tests were carried out at 620 C, a pressure of 1 atmosphere and a speed of 2 to 6cm/sec on samples of commercial austenitic Cr-Ni steels and nickel alloys in sheet form, with two different types of surface. The results showed that the general corrosion in low stress pickled sheet varied very much, the behavior improving with the nickel content. All the samples of sheet which had been cold worked by polishing with emery paper showed equally good corrosion behavior, depending less on the nickel content than on the equally high chromium content of the alloys. Of the alloys investigated, Incoloy 800 seems to be preferable for a wide range of applications, because, having 20%Cr and 30%Ni, it combines the essential properties of both types of alloys. Author

N71-32662# British Steel Corp., London (England). Special Steels Div.
COMPUTER PROGRAM FOR PREDICTING CREEP AND STRESS RUPTURE IN STEEL
N. G. Woodford 11 Dec. 1970 7 p refs
(PB-198362; SP-S-5316-10-70-C) Avail: NTIS CSCL 11F

A new version of the program to predict long term life from short term creep rupture data was written for the I.C.L. 1905F computer. To speed its operation an automatic search routine to find the optimum general time temperature parameter has been added. A system has also been included whereby it is hoped that the master curve may be constrained to be non increasing. Author (GRA)

N71-32687# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF INTERMEDIATE ANNEALING ON THE TEXTURE OF TRANSFORMER STEEL
V. E. Kochnov et al 29 Jan. 1971 10 p refs Transl. into ENGLISH from Izv. Vys. Uchebnykh Zav., Chernaya Metall. (USSR), v. 12, no. 4, 1969 p 101–104
(AD-723546; FTD-HT-23-897-70) Avail: NTIS CSCL 11/6

The article is concerned with the question of the effect of intermediate annealing conditions on the perfection of the crystallographic texture after the high-temperature annealing. Experiments were conducted with cold-rolled specimens of transformer steel. Changes in mechanical moment with various annealing conditions are outlined. It is determined that other conditions being equal, intermediate annealing temperatures can have an essential influence on the perfection of texture in sheets of transformed steel. GRA

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N71-31674# Army Foreign Science and Technology Center, Charlottesville, Va.
INDUSTRIAL APPLICATION OF EPOXY PAINT AND VARNISH MATERIALS
M. I. Finkelshtein 16 Mar. 1971 112 p refs Transl. into ENGLISH of the book "Promyshennoe Primenenie Epoksidnykh Lakokracochnykh Materialov" Moscow, Khim. Press, 1969
(AD-723425; FSTC-HT-23-070-71) Avail: NTIS CSCL 11/3

The report summarizes the experience accumulated in the application of epoxy paint and varnish materials in various branches of industry. The results of tests of the resistance of epoxy paint and varnish coatings under various operating conditions are presented. The author presents detailed data and recommendations for the selection and application of epoxy paint and varnish materials in the production of chemical fibers, instrument building and other branches of industry, depending on the operating conditions. The book is designed for engineering and technical workers in various branches of industry using paint and varnish materials as protective and decorative coatings. GRA

N71-31718# Texas Univ., Austin. Engineering Mechanics Research Lab.
A DYNAMIC INVESTIGATION OF FIBER REINFORCED VISCOELASTIC MATERIALS
H. J. Sutherland and H. H. Calvit Aberdeen Proving Ground, Md. BRL Jun. 1970 86 p refs
(Contract DAAD05-69-C-0241)
(AD-723389; EMRL-1089; BRL-CR-27) Avail: NTIS CSCL 11/4

Many mathematical models have been proposed to describe

the local and gross behavior of fiber-reinforced materials. It is the purpose of the report to examine the models that have been proposed for a particular class of fiber composites, and to use the results of a dynamic experimental program to determine their range of applicability and their accuracy. The class of fiber composites chosen for the investigation was elastic, continuous fibers embedded in a linear viscoelastic matrix. The models chosen for consideration employ the macroscopic properties of the constituents to predict the gross properties of the composite. The response of fiber-reinforced viscoelastic materials to dynamic loading may be predicted by two different analytical approaches. The first method uses the constitutive equation that is predicted by the effective modulus analysis and the dynamic field equations to determine the response of the composite. The second method, developed by Bedford and Stern, employs the dynamic moduli of each component with the dynamic continuum theory of mixtures to predict the composites response. The viscoelastic material chosen for this investigation was Solithane Resin 113. This resin was mixed with Urethane Resin Catalyst C113-300 to form a soft, rubbery material. The resin and catalyst were mixed in a 50/50 ratio (by weight). This matrix was reinforced with roving glass fibers and nylon 66 fibers. Author (GRA)

N71-31731# Army Natick Labs., Mass. Mass Clothing and Personal Life Support Equipment Lab.

DIFFUSION AND COPOLYMERIZATION OF POLYACRYLIC ACID IN NYLON 66 FIBERS TO ACHIEVE IMPROVED THERMAL PROTECTION AND HIGHER MOISTURE REGAIN

Gilbert N. Arons (M.S. Thesis – Lowell Technol. Inst., Mass.) and Richard N. Macnair Sep. 1970 47 p refs *Its* Ser. TS-74
(AD-722913; TR-71-17-CE) Avail: NTIS CSCL 11/5

An increase in the moisture absorption and melting temperature of nylon 66 is desirable for improving garment comfort and thermal resistance of nylon textile material. Grafting of acrylic acid monomer to nylon by various techniques has been intensively investigated for these purposes and also for potential protection against toxic agents. However, the possibility of copolymerizing polyacrylic acid PAA homopolymer to nylon appears to have been by-passed or considered unfeasible by other workers. The report describes the copolymerization or fixation of a relatively low molecular weight PAA to nylon by a heat cure reaction. PAA homopolymer with a molecular weight of 15,000 to 20,000 was selected and applied to a spun nylon 66 fabric from an aqueous solution containing 28 percent polyacrylic acid by weight. Thermal analysis showed a complete loss of the nylon 66 melting point endotherm and instead showed a strong endotherm at 337 C and a moderate endotherm at 230 C. A reaction between the terminal amine groups of nylon 66 and carboxyl groups of PAA forming an amide linkage was concluded to be partially responsible for the fixation. This suggested that a block copolymer and perhaps a graft copolymer were obtained. The calcium salt form increased the melting temperature of the nylon to over 385 C. Author (GRA)

N71-31747# Army Foreign Science and Technology Center, Charlottesville, Va.

PROGRESS IN POLYMER CHEMISTRY 1965

V. V. Korshak 12 Mar. 1971 408 p Transl. into ENGLISH of the book "Progress Polimernoi Khim. 1965" Moscow, Nauka Press, 1969
(AD-723595; FSTC-HT-23-1146-70) Avail: NTIS CSCL 7/3

The report represents a collection of articles pertaining to the achievements of polymer chemistry for the period 1965-1967. The role of structural factors in the formation of the properties of polymers and cationic polymerization are examined. Various types of polycondensation processes are discussed. The capacity of different elements to form polymers with inorganic molecular chains and a large group of new polymers with the silicon-nitrogen bond are examined. The successes in the synthesis of polymers with azole cycles and of organoboron and chelate polymers are generalized. GRA

N71-31750# Texas Univ., Austin. Mechanics Research Lab.

STEADY STATE STRESS WAVE PROPAGATION IN FIBER REINFORCED ELASTIC STATE

S. E. Martin Feb. 1970 43 p refs
(Contract DAAD05-69-C-0241; Grant NSF GK-4712)
(AD-723390; BRL-CR-34) Avail: NTIS CSCL 11/4

The Bedford-Stern theory of composites is used to predict the phase velocity of plane stress waves in a fiber-reinforced elastic solid. The phase velocity is found as a function of the wave number and as a function of the direction of propagation of the wave relative to the fiber direction. Also, the particle motion of each of the constituents is solved for at various wave numbers. It is found that there are four possible propagation velocities in a binary mixture of this type, and that two of these waves correspond to nearly shear motion while the remaining two correspond to nearly compressional motion. Several interesting and unexpected phenomena were found to occur at certain frequencies. Author (GRA)

N71-31762# Texas Univ., Austin. Engineering Mechanics Research Lab.

A QUASI-STATIC INVESTIGATION OF FIBER REINFORCED VISCOELASTIC MATERIALS

H. H. Calvit, H. J. Sutherland, and M. G. Wilcox, Jr. Jun. 1970 58 p refs
(Contract DAAD05-69-C-0241)
(AD-723388; EMRL-1088; BRL-CR-26) Avail: NTIS CSCL 11/4

Many mathematical models have been proposed to describe the local and gross behavior of fiber-reinforced materials. It is the purpose of the report to examine the models that have been proposed for a particular class of fiber composites, and to use the results of a quasi-static experimental program to determine their range of applicability and their accuracy. The class of fiber composites chosen for this investigation was elastic, continuous fibers embedded in a linear viscoelastic matrix. The models chosen for consideration employ the microscopic properties of the constituents to predict the gross properties of the composite. The viscoelastic material chosen for the investigation was Solithane Resin 113. This resin was mixed with URETHANE Resin Catalyst C113-300 to form a soft, rubbery material. The resin and catalyst were mixed in a 50/50 ratio (by weight). This matrix was reinforced with roving glass fibers and nylon 66 fibers. The quasi-static experimental results for glass-reinforced Solithane 113 could not be used to determine the accuracy of the effective modulus models because the roving glass fibers debonded from the matrix. The experimental results for nylon reinforcing were in close agreement with the response predicted by the effective modulus theories. Author (GRA)

N71-31775# Frost Engineering Development Corp., Englewood, Colo.

INVESTIGATION OF MATERIALS FOR SEAT CUSHION AND PARACHUTE SUPPORT SPACER DEVELOPMENT

Technical Report, Jan. 1968 – Sep. 1970
Ernest L. Stech and G. Kenneth Russell Wright-Patterson AFB, Ohio ASD Mar. 1971 61 p ref
(Contract F33657-67-C-1520)
(AD-723302; ASD-TR-70-58) Avail: NTIS CSCL 11/9

The report describes cushion material research and development which culminated in a special foam that offers a significant breakthrough in its ability to provide increased long-duration seating comfort simultaneously with reduction in the probability of spinal injury attributable to amplification of the vertical accelerations produced in upward ejections and crash landings.

Discovery of the new polyurethane material, designated as Frost XP-3, foam, is reported along with a summary of its properties and a method of approximating them by impregnation of a commercially available reticulated foam with polymeric materials. Author (GRA)

N71-31798# Army Missile Command, Redstone Arsenal, Ala. Ground Equipment and Materials Directorate.

A STUDY OF IMPACT TEST EFFECTS UPON FOAMED PLASTIC CONTAINERS

Don McDaniel 20 Apr. 1971 111 p refs

(AD-723396; RL-TR-71-2) Avail: NTIS CSCL 13/4

The report discusses the various types of foamed thermoplastic materials used as cushioning systems in military containers and their more important properties. The primary aspects of cushioning design theory currently being used by container designers to predict the response of packaged items when subjected to free-fall drop tests is discussed. The test results of all available military container designs utilizing foamed plastic cushioning systems are analyzed to determine the statistical significance of the various factors affecting container response. The analysis of the factors involved are then compared with the cushioning theory and the results are discussed. The Superimposed Dynamic Cushioning Curve technique is then presented as an improved method for presenting the cushioning properties of foamed plastic materials. Author (GRA)

N71-32007# Utah Univ., Salt Lake City. Div. of Materials Science and Engineering.

DEFECTS IN OXIDE CERAMICS Final Report, 1 Oct. 1961–30 Sep. 1970

G. R. Miller Apr. 1971 5 p refs

(Contract Nonr-1288(06))

(AD-723838; UTEC-MSE-71-077) Avail: NTIS CSCL 11/2

Dielectric and anelastic loss techniques, along with thermal depolarization spectra have been used to characterize surface and bulk point defects in MgO, CaF2 doped with oxygen and sodium and reduced SrTiO3. OH(-) surface defects in water treated MgO were found. The researchers confirmed the group theoretical analysis technique for point defect notions in CaF2, attributed the extra peaks in the thermal depolarization spectra of CaF2 doped with NaF as due to dipole-dipole interaction effects and have determined the high temperature predominant defect in SrTiO3 to be a titanium interstitial. Author (GRA)

N71-32022# Purdue Univ., Lafayette, Ind. Thermophysical Properties Research Center.

A CONTINUING SYSTEMATIC PROGRAM ON TABLES OF THERMOPHYSICAL PROPERTIES OF MATERIALS Final Technical Report, 1 Jan. 1968–31 Dec. 1970

C. Y. Ho Wright-Patterson AFB, Ohio AFML Mar. 1971 125 p refs

(Contract F33615-68-C-1229)

(AD-723309; AFML-TR-71-64) Avail: NTIS CSCL 11/7

The work reported on consists of both data tables projects and scientific documentation efforts. The data tables projects are on the thermal conductivity, specific heat, thermal radiative properties (emittance, reflectance, absorptance, transmittance), thermal diffusivity, and thermal linear and volumetric expansion of elements, ferrous and nonferrous alloys, intermetallic, semiconducting, and nonmetallic compounds, cermets, ceramics, mixtures, composites, systems, polymers, etc. and on the thermal conductivity, specific heat, and viscosity of fluids and fluid mixtures. Author (GRA)

N71-32045# United Kingdom Atomic Energy Authority, Dounreay (Scotland). Reactor Group.

THE REACTION OF PTFE WITH LIQUID SODIUM, POTASSIUM AND NaK ALLOY

C. G. Allan and J. L. Drummond 1971 5 p refs

(TRG-2104) Avail: AEC Depository Libraries; UK 6p

Small-scale tests were performed on the reaction between PTFE (poly(tetrafluoroethylene)) chips and sodium, 70:30 NaK, and potassium. Liquid metal temperatures were between 200 and 360 C and PTFE temperatures between 200 and 400 C. The PTFE charred and in some cases ignited, even in an inert atmosphere, but no explosions or violent reactions were encountered. Author (NSA)

N71-32097 National Lending Library for Science and Technology, Boston Spa (England).

INFLUENCE OF SIZE IN THE LUBRICATING ACTION OF GLASS

L. Arizmendi et al 12 Mar. 1971 16 p Transl. into ENGLISH from Proceedings of the 14th Bien. Meeting of the Roy. Spanish Soc. of Phys. and Chem., Seville, Sep. 1969

(NLL-RISLEY-Trans-2091-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The action of glass particles used as additive to improve the lubricating properties of mineral oils is studied, with special reference to the infuence of the glass particle size. A hypothesis is proposed concerning a possible relation between the glass size and the surface finish based on surface roughness. A method for prepartion of the additive is described. Author

N71-32216# Sandia Corp., Albuquerque, N.Mex.

ADVANCED FILAMENT-WOUND CARBON COMPOSITE

T. R. Guess, B. L. Butler, and J. D. Theis Mar. 1971 41 p refs Sponsored by AEC

(SC-DR-710192) Avail: NTIS

Experimental mechanical properties data are presented for a composite of GSCY2-5 carbon filaments and a CVD (chemical vapor deposited) carbon matrix. Tension tests were conducted on single fibers, single yarn bundles with CVD matrix, and filament-wound carbon composite tubes. The circular cylindrical tubes were loaded in axial tension and in hoop tension (by a pressurized bladder). The data are compared to calculated results based on micromechanics and lamination theories for filamentary composites. Author

N71-32225# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

FRICTION AND WEAR OF HIGH-POLYMER MATERIALS

A. A. Kutkov et al 8 Jan. 1971 10 p refs Transl. into ENGLISH from Tr. Politekhn. Inst. (Novocherkassk), no. 187, 1969 p 114–116

(AD-723544; FTD-HT-23-822-70) Avail: NTIS CSCL 13/9

The idea is expressed that studying the phenomena occurring during friction of a polymer-metal pair at superlow speeds might give interesting results which would confirm the hypothesis of oxidative wear. The authors based this proposal on the following considerations: relaxation processes occur continuously on the friction surface of a polymer specimen. Owing to the discrete nature of the contact these processes are reduced and attenuated in certain segments and arise and develop in others. The mechanical destruction of macromolecules and the consequent oxidative wear of the adjacent metallic part occur both as the result of direct mechanical deformation of the macromolecule (shearing, breaking) and because of fatigue phenomena. It is evident that the frequency and magnitude of the relaxation processes on the polymer friction surface, and also the scale of direct mechanical destruction, will depend on the slip speed. Author (GRA)

N71-32320*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

FORMULATION PROCEDURE AND SPECTRAL DATA FOR A HIGHLY REFLECTING COATING FROM 200 nm TO 2300 nm

Charles M. Shai and John B. Schutt Jul. 1971 11 p refs
(NASA-TM-X-65653; X-762-71-266) Avail: NTIS CSCL 11D

A method for formulating a highly reflecting and mechanically stable coating from very pure barium sulphate is carefully detailed. Reflectance data are presented for this coating from 200 nm to 2500 nm and compared with the commercially available Eastman Kodak preformulated coating as well as freshly smoked magnesium oxide. Compared to the Eastman coating, the one detailed in the body of this report has the advantages of somewhat higher reflectance values throughout the spectral region of interest as well as greater ease of handling. Author

N71-32349*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NEW DIRECTIONS IN MATERIALS RESEARCH DICTATED BY STRINGENT FUTURE REQUIREMENTS
S. S. Manson 1971 60 p refs Presented at Intern. Conf. on the Mech. Behavior of Materials, Kyoto, 15–20 Aug. 1971
(NASA-TM-X-67885) Avail: NTIS CSCL 11D

The stringent materials requirements associated with advanced projects such as automotive thermal reactors, jet engines, space shuttle and space nuclear power systems are outlined. Specific results are cited for metal and polymer matrix materials, dispersion strengthening, directional solidification, powder metallurgy, and materials of novel composition. Cryogenic fatigue and fracture, as well as high temperature creep and fatigue are also discussed, with the emphasis placed on new facilities and new analytical techniques that are being developed to treat these problems. Author

N71-32414*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECTS OF THERMAL AND ENVIRONMENTAL EXPOSURE ON THE MECHANICAL PROPERTIES OF GRAPHITE/POLYIMIDE COMPOSITES
M. P. Hanson and T. T. Serafini [1971] 11 p refs Proposed for presentation at Fall Meeting of the Soc. of Aerospace Mater. and Process Engr., Huntsville, Ala., 5–7 Oct. 1971
(NASA-TM-X-67893) Avail: NTIS CSCL 11D

Composites were exposed in circulating and static air environments up to 600 F for a maximum of 1000 hours. Composites of HT-S, HM-S, Thornel 50S, and Fortafil 5-Y fiber and a new addition type polyimide resin were laminated in a matched-die mold. Flexural strength, flexural modulus, and interlaminar shear strengths were determined at 75, 500, and 600 F after various durations of exposure. Composite and fiber weight loss characteristics were determined by isothermal gravimetric analysis in air. Properties of composites exposed and tested at the environment temperatures are compared with those determined under short-term exposure. A new short beam interlaminar shear fixture is described. Environmental effects of long-term (up to one year) ambient temperature exposure on the elevated temperature mechanical properties of graphite/polyimide composites are presented. Author

N71-32584# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.
SOME EXPERIMENTAL RESULTS ON THE SORPTION OF CAESIUM BY TUNGSTEN AND GRAPHITE
G. F. DeBeni, O. Gautsch, and H. Wehl 24 Jul. 1970 18 p refs
(EUR-4549) Avail: AEC Depository Libraries; EUR FF 4.45

A submicron W powder, a nuclear graphite, and a pyrolytic graphite sample were loaded with Cs at sample temperatures between 600 and 800 C and Cs vapor pressure from about 0.01 to 30 mm Hg to see whether such systems could be used as Cs reservoirs in thermionic converters. The amounts of Cs sorbed by the samples at a given temperature as a function of time were measured by a radioactive tracer method using Cs-134. From these sorption curves the saturation loadings and the corresponding equilibrium pressures of the Cs vapor were determined. The graphite samples attained saturation loadings of up to 1500 mg/g and the loading isotherms showed transition stages corresponding to compounds between C24Cs and C10Cs roughly. In the temperature range of 700 to 800 C these compounds had vapor pressures between 1 and 10 mm Hg. For a pressure decrease of 20% Cs amounts of 10 to 200 mg/g were released. The pressure, temperature and loading characteristics of the Cs-graphite systems are more suitable for a practical use in a converter than those of the tested W powder. Author (NSA)

N71-32585# Princeton Univ., N.J. Dept. of Aerospace and Mechanical Sciences.
PROPAGATION OF PLANE WAVES IN ANISOTROPIC MICROPOLAR ELASTIC MEDIA WITH APPLICATIONS TO COMPOSITE MATERIALS
D. Ozgur and T. R. Tauchert Feb. 1971 94 p refs
(Contract DAHC04-70-C-009; Grant DA-ARO(D)-31-124-71-G7)
(AD-723417; AMS-933; AROD-9626-1-A) Avail: NTIS CSCL 11/4

In the present work, the propagation of plane harmonic waves in an anisotropic, micropolar elastic media is studied. The special cases of plane harmonic waves in unbounded orthotropic micropolar and tetragonal micropolar elastic media are studied in detail. Propagation of plane waves in an arbitrary direction is considered and, in particular, the waves propagating along the symmetry axes of the media are closely analysed. The velocity dispersion relations and the mode shapes are obtained and discussed. Reflection of plane waves from a stress free plane surface is studied. This problem is considered in two dimensions only, in order to avoid tedious calculations. An approximate method based on a three dimensional lattice model is used to determine the micropolar elastic moduli. Certain restrictions are imposed on the orthotropic micropolar elastic media considering the non-negativeness of the internal energy. The results are applied to a carbon-phenolic resin composite. Author (GRA)

N71-32671# Defense Documentation Center, Alexandria, Va.
PROTECTIVE TREATMENTS, INDUSTRIAL PROCESSING SERIES, VOLUME 1 Report Bibliography, Jan. 1961–Feb. 1970
Mar. 1971 95 p refs
(AD-722800; DDC-TAS-70-84-1-Vol-1) Avail: NTIS CSCL 11/3

The volume consists of 59 annotated references grouped under three major headings Anodic coatings, antifouling coatings, and diffusion coatings. Entries are sequenced numerically within each group and cover the period from January 1953 to January 1971. Volume II is confidential. Corporate author-monitoring agency, subject, title, report number and AD number indexes are included. Author (GRA)

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 09 Computers.

N71-31685# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
INFRARED TWO DIMENSIONAL IMAGE ANALYSIS BY FOURIER TRANSFORM [ANALYSE BIDIMENSIONNELLE D'IMAGES PAR TRANSFORMEE DE FOURIER EN INFRAROUGE]
Dominique Mergerand (Ph.D. Thesis–Paris Univ., 1971) 1970 85 p refs In FRENCH; ENGLISH summary
(ONERA-NT-164) Avail: NTIS

The analysis of a luminance distribution on a surface is usually made by isolating each surface element by means of a diaphragm which determines, by its own dimensions, the resolution limit. The proposed process rests on the use of a hyperbolic grille which delivers in an analog form the Fourier transform of the two dimensional image of the luminances being studied. The general principle of the method is given. The grilles used, the object, and the type of scanning are described. The analytical study of the signal; its retrieval, and the problems involved in the numerical retrieval are analyzed. The causes of error and the analysis of the gain in signal/noise ratio are discussed.
Author (ESRO)

N71-31823# Illinois Univ., Urbana. Coordinated Science Lab.
A MANIFOLD IMBEDDING ALGORITHM FOR OPTIMIZATION PROBLEMS
Yves Raymond Hontoir Apr. 1971 52 p refs
(Contract DAAB07-67-C-0199; Grant AF-AFOSR-1579-68)
(AD-723441; R-505; UILU-ENG-71-2208) Avail: NTIS CSCL 12/1

An algorithm is described for the solution of two-point boundary-value problems arising in optimization problems. The one-parameter imbedding used affects the initial and terminal manifolds and leaves the system equations unchanged. In contrast to an existing imbedding technique, the intermediate problems in this method have a physical meaning, which facilitates the choice of a proper imbedding. A reduction of computation time is also achieved and the algorithm applies to a wider variety of optimization problems. One of the numerical examples presented is the minimization of the transfer time between Earth and Mars.
Author (GRA)

N71-31987# Stanford Univ., Calif. Electronics Labs.
A STUDY OF SUBHARMONIC RESPONSE IN NONLINEAR SYSTEM MODELS
Niles Ransom Moseley Apr. 1971 118 p refs
(Contract N00014-67-A-0112-0044)
(AD-723216; SU-SEL-71-018; TR-6657-3) Avail: NTIS CSCL 12/1

The report investigates the system model G(u, u dot, . . ., u sup n, t) = F(t), where F(t) is a periodic excitation. Using an approximate solution of the form u(t) = Summation, R = 0 to UH (U sub c)(R) cos R (omega sub o) t + (U sub s) (R) sin R (omega sub o) t), analytical theorems and computer results are obtained that yield information into the nature of the existence and non-existence of subharmonic components in the response. By assuming G(u, u dot, . . . , u sup n, t) to be a polynomial, theorems are developed that determine the conditions for the possible existence and non-existence of subharmonic response.
Author (GRA)

N71-32008# Naval Ship Engineering Center, Philadelphia, Pa. Engineering Branch.
A SELF ADAPTIVE MODEL REFERENCE AUTOMATIC CONTROL SYSTEM FOR A NON-LINEAR PROCESS Final Report
Pierce H. Zavod 31 Mar. 1971 83 p refs
(AD-722322; NAVSECPHILADIV-C-5-11) Avail: NTIS CSCL 12/1

The equations describing the dynamic properties of a typical non-linear load disturbed system were derived with the objective of developing a superior control system in this application through use of analog computer function optimization techniques. The automatic control systems generally used in this application employ proportional-plus-integral devices as the controller in the closed loop. The determination of the optimum values of the coefficients of the proportional and integral terms is normally accomplished by trial and error procedures. In an effort to obviate this procedure, the method developed computed the optimum values of gain and integration constant of a conventional proportional-plus-integral controller using an analog computer operating iteratively and in fast time. The results of this computation were applied directly to the settings of a controller in a closed loop system operating in real time. The speed of the optimization process was such that optimum controller settings were determined for a disturbance after the disturbance had taken placed but before the process had responded to any significant degree.
Author (GRA)

N71-32016# Joint Publications Research Service, Washington, D.C.
MATHEMATICS AND THE SCIENTIFIC METHOD
23 Jul. 1971 53 p refs Transl. into ENGLISH from Filosofskiye Nauki (Moscow), no. 3, 1971 p 3–11 and 33–58
(JPRS-53668) Avail: NTIS

CONTENTS:
1. ROLE OF MATHEMATICS IN KNOWLEDGE DESCRIBED A. Nysandayev et al p 1–13 refs (See N71-32017 19-19)
2. ORIGIN OF SCIENCE MODELS DESCRIBED. V. S. Stepin p 14–25 refs (See N71-32018 19-19)
3. NATURE OF SOCIAL FORECASTING DESCRIBED M. N. Rutkevich et al p 26–38 refs (See N71-32019 19-34)
4. SOCIAL ASPECTS OF PREVISION DISCUSSED O. B. Nikolayev p 39–50 refs (See N71-32020 19-34)

N71-32017# Joint Publications Research Service, Washington, D.C.
ROLE OF MATHEMATICS IN KNOWLEDGE DESCRIBED
A. Nysandayev et al *In its* Math. and the Sci. Method 23 Jul. 1971 p 1–13 refs (See N71-32016 19-19)
Avail: NTIS

The role and functions of modern mathematics as a method of knowledge are considered as a fact that gives the researcher a specific method for approaching the real facts and for seeing them. The semantic function of mathematics in science is developed briefly for examples considering the concept of language symbols and the design of formalized logarithmic languages.
G.G.

N71-32018# Joint Publications Research Service, Washington, D.C.
ORIGIN OF SCIENCE MODELS DESCRIBED
V. S. Stepin *In its* Math. and The Sci. Method 23 Jul. 1971 p 14–25 refs (See N71-32016 19-19)
Avail: NTIS

The organization of theoretical knowledge into primary theoretical models and systems on which development theories are based are discussed. Empirical systems are created as particular correlations to the real objects and act as models of experimental measurements to depict research objects. The cybernetic model of an object is a complex system in which evoluting subsystems operate on the bases of separate and reorganizing programs for the entire complex entity.
G.G.

N71-32047# Joint Publications Research Service, Washington, D.C.
LINEAR DIFFERENTIAL GAMES
21 Jul. 1971 14 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), no. 4 and 5, 1971 p 777–780, 1018–1021
(JPRS-53645) Avail: NTIS

CONTENTS:
1. LINEAR DIFFERENTIAL DIFFERENCE GAMES N. N. Krasovskiy et al p 1–6 refs (See N71-32048 19-19)
2. LINEAR DIFFERENTIAL GAMES OF PURSUIT IN THE PRESENCE OF DELAYS M. S. Nikolskiy p 7–12 refs (See N71-32049 19-19)

N71-32048# Joint Publications Research Service, Washington, D.C.
LINEAR DIFFERENTIAL DIFFERENCE GAMES
N. N. Krasovskiy et al *In its* Linear Differential Games 21 Jul. 1971 p 1–6 refs (See N71-32047 19-19)
Avail: NTIS

The game problem of reducing motion to a given set is examined for linear differential systems with aftereffects. The strategies and conditions derived are useful for situations involving collision motions and related problems in applied mathematics and mechanics. A.C.R.

N71-32049# Joint Publications Research Service, Washington, D.C.
LINEAR DIFFERENTIAL GAMES OF PURSUIT IN THE PRESENCE OF DELAYS
M. S. Nikolskiy *In its* Linear Differential Games 21 Jul. 1971 p 7–12 refs (See N71-32047 19-19)
Avail: NTIS

Linear differential games of pursuit in the presence of delays are analyzed. Solutions required for successful completion of pursuit within a finite time from the initial state are identified. A.C.R.

N71-32091# Joint Publications Research Service, Washington, D.C.
STOCHASTIC SYSTEM COMBINATIONS DISCUSSED
V. S. Pugachev *In its* Cybernetics and Regulation Theory 6 Jul. 1971 p 15–19 (See N71-32088 19-04)
Avail: NTIS

Methods are proposed for determining the characteristics of any combination of stochastic system according to data pertaining to the simpler systems forming a part of them. These complex systems include mass service systems and any system involving people. The concepts of parallel combinations, series links, and feedback connections are applied to these systems in determining their characteristics. E.M.C.

N71-32217# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.
CORRECTION OF INSPECTION DATA FOR PART MISALIGNMENT UTILIZING A SMALL COMPUTER
T. W. Bookhart, R. J. Easterday, and W. Q. Walter 16 Apr. 1971 40 p refs
(Contract W-7405-eng-26)
(Y-1755) Avail: NTIS

Algorithms are presented for determining and correcting for the misalignment of the axes of a surface of revolution, with respect to the axes of a dimensional inspection machine. Measured deviations from part datum surfaces are used to compute the part misalignment. These algorithms were programmed and incorporated as a portion of the control program for a two-axis, computer-controlled dimensional inspection machine. Author

N71-32257 Virginia Univ., Charlottesville.
SEVERAL BOUNDARY VALUE PROBLEMS INVOLVING QUADRATIC EIGENVALUE EQUATIONS
Cipher Alston Desvours (Ph.D. Thesis) 1969 83 p
Avail: Univ. Microfilms Order No. 70-4780

Two boundary value problems on a semi-infinite strip are solved in terms of eigenfunction expansions. The equation d sub xx-d sub tt = (1-chi sq)d sub t is considered with the usual type of mixed boundary conditions on the strip. By a generalised method of separation of variables the study of the problem is reduced to the consideration of a nonlinear eigenvalue problem for which the relevant theorems are then proved using complex variable techniques. The equation d sub xx + d sub yy = (1-chi sq)d sub y is also studied. The given boundary conditions are of the Cauchy type with the restriction that the solution tend to zero along the strip. This problem too is reduced to a study of a certain nonlinear eigenvalue problem which is then solved. In both cases, the theorems and proofs are applicable to much more general problems than considered. Dissert. Abstr.

N71-32269 New York Univ., N.Y.
A FINITE DIFFERENCE METHOD FOR THE SOLUTION OF FREE BOUNDARY PROBLEMS
Eugene Bloch (Ph.D. Thesis) 1969 119 p
Avail: Univ. Microfilms Order No. 70-16038

A systematic iterative procedure is described which yields finite difference solutions to steady free boundary problems of plasma physics and fluid dynamics. By application of the method of steepest descent to minimize certain energy functionals connected with conformal mapping and free boundary problems, a system of artificially time-dependent equations is produced which converges to a steady state as the time parameter goes to infinity. The solution is obtained in a parametric form in which the physical plane is the conformal image of a fixed rectangle. The use of a fixed rectangle as the parameter domain enables the treatment of the difficulties engendered by the singular behavior of the stream function at the point of separation between the fixed and free boundaries. As a result the scheme can be made convergent to second order in the mesh width h. Dissert. Abstr.

N71-32271 National Lending Library for Science and Technology, Boston Spa (England).
INVESTIGATION OF CLASSIFIERS USING A MATHEMATICAL MODEL
D. Schmid 17 Nov. 1970 21 p refs Transl. into ENGLISH from NTZ-Nachr. Tech. Z. (Brunswick), v. 23, no. 3, 1970 p 151–157 (NLL-Trans-2670-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Classifications as coordinate transformations are discussed as well as the distance and angle criteria of class allocation. Class vector-system selection, the transformation function, behavior of class boundaries in feature spaces, and improvement by the common point displacement of intersections of separating hyperplanes are included. J.M.

N71-32312# RAND Corp., Santa Monica, Calif.
MINIMAL k-arc CONNECTED GRAPH
D. R. Fulkerson and L. S. Shapley Jan. 1971 14 p refs
(P-2371-1) Avail: NTIS

The problem of determining the least number of arcs required in a k-arc-connected graph on n nodes is solved by describing constructions that produce such graphs having kn/2 arcs (for kn even) or (kn+1)/2 arcs (for kn odd). These results have application to the practical problem of synthesizing minimum cost, k-reliable communication networks. Author

N71-32344# Union Carbide Corp., Oak Ridge, Tenn.
CUBIC INTERPOLATION FOR NUMERICALLY CONTROLLED MACHINES
R. V. Miskell 31 Mar. 1971 54 p refs
(Contract W-7405-eng-26)
(Y-1782) Avail: NTIS

A third-order interpolation technique for continuous-path, numerically controlled machines is developed. The interpolation method is based upon the digital integration of parametric cubic equations. Dimensional and velocity errors associated with the cubic interpolator are analyzed and discussed. The results of the evaluation substantiates the use of the cubic interpolator as a means to reduce data requirements for numerically controlled machines and still maintain dimensional and velocity accuracies. Author

N71-32448 Maryland Univ., College Park.
NUMERICAL METHODS FOR ELLIPTIC BOUNDARY PROBLEMS

Stephen Russell Hilbert (Ph.D. Thesis) 1969 73 p
Avail: Univ. Microfilms Order No. 70-14939

Approximants are constructed for the solutions of elliptic boundary problems and the resulting errors are analyzed. Both difference methods and variational methods are employed. A class of generalized difference operators and associated symbols is defined. Elliptic generalized difference operators are defined in terms of the symbol. By use of the discrete Fourier transform the symbol is related to error estimates. The operators are used for problems on bounded domains and the entire space. Some results on approximation of functions in N dimensions are obtained. A special smoothing operator is constructed. This smoothing operator is then used in a method for finding approximants for functions which are not necessarily continuous. The method is applied to the problem of finding approximants in the space of Hermite functions and in a certain class of spline functions. Dissert. Abstr.

N71-32461 Pennsylvania Univ., Philadelphia.
THE E(2) EXPANSION
Robert Olshansky (Ph.D. Thesis) 1969 108 p
Avail: Univ. Microfilms Order No. 70-16193

A study is made of the crossed-channel E(2) expansion of the t=0, unequal mass scattering amplitude. Assuming the scattering amplitude satisfies the Mandelstam representation and has a definite asymptotic behavior, the properties of the E(2) partial wave amplitude in the plane of the complex Casimir operator are derived. Equations are found which relate the E(2) expansion to the O(2,1) and Regge representations. From these it can be seen that the properties of the E(2) amplitude and the properties of the Froissart–Gribov partial wave amplitudes containing daughter trajectories are equivalent. Dissert. Abstr.

N71-32467# Sandia Corp., Albuquerque, N.Mex.
COMPACTNESS BY BOUNDED L Sub p VARIATION
D. L. Hicks and B. Epstein (N. Mex. Univ.) Feb. 1971 16 p refs
(SC-RR-70-852) Avail: NTIS

The concept of bounded variation is generalized and extended to higher dimensions so as to get compactness of function sequences in L sub p- spaces. Helly's Theorem and Rellich's Lemma become corollaries to this general bounded variation compactness theorem. The theorem is so formulated as to be readily applied to the study of compactness and convergence in finite-difference techniques used for the computation of discontinuous profiles. Author

N71-32473*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
IDENTIFICATION OF SYSTEM PARAMETERS FROM INPUT-OUTPUT DATA WITH APPLICATION TO AIR VEHICLES
Dallas G. Denery (Ph.D. Thesis–Stanford Univ.) Washington Aug. 1971 146 p refs
(NASA-TN-D-6468; A-3901) Avail: NTIS CSCL 12A

A new algorithm is developed for estimating system parameters from input-output data. If the noise or uncertainty in the system is small, the algorithm does not require a prior estimate of the unknown parameters and if the noise has a zero mean, the final parameter estimates will not be biased. A method for reducing the computations required to obtain the parameter estimates is also presented. A general canonical realization is developed for multi-input, multioutput, constant-coefficient, linear equations. If the unknown system is modeled in its canonical form, the unknown parameters are uniquely identifiable. An analogy is established between a parameter estimation procedure developed by Shinbrot and the concept of linear observers developed by Luenberger. It is shown that observers of lower order can be designed quite easily using an extension of Shinbrot's method. Author

N71-32487# Wisconsin Univ., Milwaukee.
BOUNDARY FUNCTIONS AND SETS OF ASYMPTOTIC VALUES
J. L. Stebbins [1970] 18 p refs
Avail: NTIS

A technique for constructing functions meromorphic in the unit disk with specific preassigned asymptotic behavior at the boundary is presented. The applications which inspired the construction method are presented, and the unit disk chosen because of the precision that could be obtained at each point on the boundary is evaluated. Author

N71-32502# Joint Publications Research Service, Washington, D.C.
SIMULATION OF THE NEURAL NET
V. I. Lesis et al 13 Jul. 1971 8 p refs Transl. into ENGLISH from Tr. Akad. Nauk Litovsk. SSR (USSR), Ser. B, v. 1, no. 64, 1971 p 225–230
(JPRS-53581) Avail: NTIS

Models of neural nets are considered to have the capability of classifying the external stimulus and remembering it. Even simple models of the neural net possess these two properties. Methods of analysis on models of neural nets, which permit evaluation of internal changes in their activity are considered. A similarity matrix makes it possible to determine the moment of the appearance of rhythm in the net. Author

N71-32541# RAND Corp., Santa Monica, Calif.
IS COLLINEARITY A PROBLEM?
Joseph P. Newhouse Mar. 1971 7 p
(P-4588) Avail: NTIS

Several Monte Carlo experiments are reported which indicate that collinearity is not as important a problem in applied econometric work as previously thought from the frequency with which it is cited to explain poor results. A least squares method is used to solve equations for evaluating the influence of collinearity on t-test results. It is also shown that the concern over the impairment of prediction by collinearity is likewise exaggerated. A.C.R.

N71-32545*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ATTITUDE DETERMINATION AND SENSOR ALIGNMENT VIA WEIGHTED LEAST SQUARES AFFINE TRANSFORMATIONS
Paul B. Davenport Aug. 1971 37 p refs Presented at the AAS/AIAA Astrodyn. Specialists Conf., Ft. Lauderdale, Fla. 17-19 Aug. 1971
(NASA-TM-X-65863; X514-71-312; AAS-71-396) Avail: NTIS CSCL 12A

The position and orientation of a vehicle, sensor, actuator, etc., relative to a fixed set of axes (another vehicle, sensor, etc.) may be represented mathematically by an affine transformation (linear transformation plus a translation). Symbolically, Z = MX + V, where M is an mxn matrix, V and Z are mx1 column vectors, and X is an nx1 vector. This matrix equation also represents any linear relationship between known inputs X and measured outputs Z; e.g., if X is the first n powers of a scalar x then each component of Z is a polynomial in x. The weighted least squares estimate of M and V is discussed assuming that various measurements Z are given (along with the input X). Although there are m(n+1) parameters to be estimated, a simple weighting function allows a solution by inverting only an nxn matrix. This case, including constraints on M (orthogonal, rotation, symmetric and skew-symmetric) are examined in detail. Author

N71-32582 National Lending Library for Science and Technology, Boston Spa (England).
DEDUCTIONS BY SEARCH TACTICS BASED ON

UNIFICATION OF THE ORDER OF TERMS IN FAVOURABLE SETS [TAKTIKI POISKA VYVODA, OSNOVANNYE NA UNIFIKATSII PERYADKA CHLENEV V SLAGEPRIYATNEM NABORE]
S. Yu. Maslov Oct. 1970 13 p refs Transl. into ENGLISH from Zap. Nauch. Seminarov. Lenin. Otdel. Mat. Inst. Im Steklova, A.N. SSSR (USSR), v. 16, 1969 p 126-136 Presented at the Seminar on Mathematical Logic, Leningrad, 3 Apr. 1969
(NLL-RTS-5858) Avail: Natl. Lending Library, Boston Spa, Engl.: 20 s; 3 NLL photocopy coupons

Several specializations in the process of forming favorable sets are established. The specializations were designed to deduce formula for the classical calculus of predicates with functional signs by the inverse method. The specializations also limit the sorting involved in substantiating favorable vacant sets without any loss in deducibility. Restrictions are mainly associated with disregard for sets in which the order of the terms does not correspond to a prescribed order. E.H.W.

N71-32683# RAND Corp., Santa Monica, Calif.
INTEGER PROGRAMMING AND K-th SHORTEST PATHS
B. L. Fox Mar. 1971 5 p refs
(P-4592) Avail: NTIS

An extension of Gomory's theorem for the case when a given integer is nonnegative is extended for the case when it is not. Yen's modification of Dijkstra's algorithm is used to find shortest paths. If the paths with loops have positive length and there is an upper bound on the value of the solution, convergence is finite. A perturbation method is utilized to assure finite convergence. E.H.W.

N71-32803# University of Southern Calif., Los Angeles. Dept. of Mathematics, Electrical Engineering and Medicine.
ON THE ANALYTIC FORMALISM OF THE THEORY OF FUZZY SETS
Richard Bellman and Magnus Giertz (Royal Inst. of Technol.) May 1971 12 p ref
(Grant GM-16197-03)
(TR-71-20) Avail: NTIS

The extension of standard concepts of set theory of Zadeh's theory of fuzzy sets was considered, and definitions were proposed for accepting an object as a member of a particular set. Topics discussed included: fuzzy sets and fuzzy statements; basic assumptions, notations, and restriction; determination of truth values of compound statements; and the negation of fuzzy statements. J.G.M.

N71-32810*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A COMPARISON OF COWELL VS POWER SERIES NUMERICAL INTEGRATION AS APPLIED TO ORBITAL CALCULATIONS
C. E. Velez and R. V. Borchers Mar. 1971 28 p refs
(NASA-TM-X-65648; X-553-71-106) Avail: NTIS CSCL 12A

The results are presented of a comparison of the classical Cowell numerical integration method with the power series integration method as applied to artificial satellite orbital calculations. These integration methods are described in detail, the relative advantages and disadvantages of each are discussed, and numerical examples are given. The conclusion derived is that if the orbital motion is governed by a simple, smooth force model, the power series method is most effective; however, for applications involving complex or nonsmooth models, such as those occurring in definitive near-Earth trajectory calculations, the Cowell technique is more efficient. For example, the power series method is shown to be 10 to 15 times more expensive than the Cowell method when used to integrate the motion of an Earth satellite such as GEOS-B; yet both methods achieve equivalent accuracies. Author

N71-32891# Syracuse Univ., N.Y. Dept. of Physics.
DILATATION AND CONFORMAL INVARIANCE ON NULL PLANES
F. Rohrlich and L. Streit Jul. 1971 14 p refs Sponsored by NSF
Avail: NTIS

It is proven that a relativistic scalar field, whose null plane restriction exists, and which has c-number commutation relations there, transforms covariantly under dilatation and conformal transformations on a null plane. These transformations are thus unitarily implementable. The restriction of the conformal algebra to the null plane is discussed. Author

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N71-31626# Public Health Service, Cincinnati, Ohio. Air Resources Field Research Office.
WORKBOOK OF ATMOSPHERIC DISPERSION ESTIMATES
D. Bruce Turner 1970 101 p refs Revised
(PB-191482; PHS-999-AP-26) Avail: NTIS CSCL 13B

Methods of practical application of the binormal continuous plume dispersion model to estimate concentrations of air pollutants are presented. Emphasis is on the estimation of concentrations from continuous sources for sampling times up to 1 hour. Discussions include determination of effective height of emission, extension of concentration estimates to longer sampling intervals, inversion break-up fumigation concentrations, and concentrations from area, line, and multiple sources. Twenty-six example problems and their solutions are given. Some graphical aids to computation are included. Author

N71-31657# Institut Royal Meteorologique de Belgique, Brussels.
CLIMATOLOGICAL OBSERVATIONS. Monthly Bulletin, May 1971 [OBSERVATIONS CLIMATOLOGIQUES. BULLETIN MENSUEL, MAI 1971]
1971 15 p In FRENCH and DUTCH
Avail: NTIS

Meteorological parameters observed at different Belgian weather stations during May 1971 are given. ESRO

N71-31665# Cologne Univ. (West Germany). Inst. fuer Geophysik und Meteorologie.
INTERPOLATION AND REPRESENTATION OF TWO DIMENSIONAL FIELDS [INTERPOLATION UND DARSTELLUNG ZWEIDIMENSIONALER FELDER]
M. Laube Oct. 1970 56 p refs In GERMAN; ENGLISH summary Sponsored by Fraunhofer Ges. *Its* Mitt. No. 15
Avail: NTIS

A method is described for the definition of an initial state of the atmosphere on the basis of analyzed weather maps. This method uses a two dimensional cubic interpolation formula. The interpolated field is corrected by additional values for the resolution of mesoscale eddies. The weight of these values depends upon the distance. In addition a method is given for graphical output of two dimensional fields without using a data plotter but with the aid of electronic computers. Since the construction of weather maps is not an isolated step within the numerical simulation of atmospheric behavior, this operation should be performed using the same computer. Author (ESRO)

N71-31677# Drexel Inst. of Tech., Philadelphia, Pa.
COMPARISONS OF H2O VAPOR PROFILES OBTAINED BY RADIOSONDE AND LASER BACKSCATTER

John A. Cooney Nov. 1970 59 p refs
(Contract F19628-69-C-0092; Proj. Themis)
(AD-723301; SR-3; AFCRL-70-0883) Avail: NTIS CSCL 4/2

Vertical profiles of atmospheric absolute humidity were obtained between 500m and 2000m by monitoring an appropriate portion of the Raman component of laser backscatter and were compared with radiosonde data taken at essentially the same time and place. Comparative accuracies of about 10% relative accuracy and 13% absolute accuracy were measured. A parity with the radiosonde accuracy is shown for the laser method of measuring humidity. Author (GRA)

N71-31686# Institut Royal Meteorologique de Belgique, Brussels. Regie des Voies Aeriennes et Force Aerienne.
SYNOPTIC OBSERVATIONS Monthly Bulletin, Oct. 1969 [OBSERVATIONS SYNOPTIQUES Bulletin Mensuel, Octobre 1969]
1969 31 p In FRENCH and DUTCH
Avail: NTIS

Synoptic measurements made at different Belgian weather stations in October 1969 are presented. ESRO

N71-31687# Institut Royal Meteorologique de Belgique, Brussels. Regie des Voies Aeriennes et Force Aerienne.
SYNOPTIC OBSERVATIONS Monthly Bulletin, Sep. 1969 [OBSERVATIONS SYNOPTIQUES BULLETIN MENSUEL, SEPTEMBRE 1969]
1969 31 p In FRENCH and DUTCH
Avail: NTIS

Synoptic measurements made at different Belgian weather stations in September 1969 are presented. ESRO

N71-31713# California Univ., Los Angeles. Water Resources Center.
PACIFIC OCEAN INFLUENCE UPON CALIFORNIA RAINFALL
Charles B. Pyke and Jacob Bjerknes 30 Nov. 1970 32 p
(PB-198126; UCAL-WRC-W-254; W71-08115;
OWRR-A-021-CAL) Avail: NTIS CSCL 04B

The climatic patterns of precipitation in the western United States and Baja California were examined in considerable detail. Of particular concern are the three prominent seasonal precipitation maxima: the winter maximum which occurs in all coastal and most interior sections, the summer maximum in the interior deserts of the southwestern United States and in Baja California, and the late spring maximum in the interior of the Pacific Northwest United States. The winter precipitation maximum is associated with extratropical cyclones of the north Pacific Ocean; and in the mean this maximum progresses generally southward along the west coast of the United States with time, occurring in early December in northwestern Washington and in mid-February in portions of coastal southern California. This southward progression appears to be related to the general southward displacement of the mean upper tropospheric jet stream and the associated north Pacific storm track during the late fall and winter. The warm-season rainfall maxima which are observed in the interior portions of the western United States and Baja California appear to result from convective activity occurring within warm, unstable air masses. GRA

N71-31715# Air Weather Service, Scott AFB, Ill.
FORECASTERS' GUIDE TO TROPICAL METEOROLOGY
Gary D. Atkinson 1 Apr. 1971 367 p refs
(AD-723392; AWS-TR-240) Avail: NTIS HC $6.00/MF $0.95 CSCL 4/2

A practical manual is presented for training and reference use of USAF weather forecasters who will work in the tropics. It covers basic facts of climatology circulation, synoptic models, analysis and forecasting, applicable throughout the tropics. A broad survey is made of the literature, evaluated in light of the experience of the author. Physical factors controlling tropical circulations are briefly discussed. The data sources for synoptic purposes are reviewed. Climatology of pressure, winds, temperature, humidity, clouds, rainfall and disturbances is presented in a form specially suitable for forecasters. Analysis and forecasting of disturbances, cyclones, severe weather, terminal weather, etc., are treated at length. Emphasis is placed on uses of climatology and satellite cloud photos. Over 230 figures adapted from the literature or prepared by the author serve to illustrate all the essential facts and principles discussed. A summary of the state of art and future outlook of tropical meteorology is included. Author (GRA)

N71-31716# Deutscher Wetterdienst, Hohenpeissenberg (West Germany). Meteorologisches Observatorium.
RESULTS OF AEROLOGICAL OZONE SOUNDINGS AT THE HOHENPEISSENBERG METEOROLOGICAL OBSERVATORY, PART 7 Final Report, Jan.–Jun. 1970
Walter Attmannspacher Mar. 1971 129 p
(Contract DAHA37-67-C-0317)
(AD-723486; ARDG(E)-E-1093-Pt-7) Avail: NTIS CSCL 4/1

These special reports represent a mass of data in tabular and map form taken in Hohenpeissenberg for 1970, taken at different levels during the passage of storms and fronts. Included are: ozone tables and ozonagrams; tables and ascent data including those for temperatures, pressures and winds aloft. Author (GRA)

N71-31739# Naval Intelligence Command, Alexandria, Va. Translation Div.
THE METEOROLOGICAL COMPLEX OF THE TELEVISION TOWER IN OSTANKINO (MOSCOW) [METEOROLOGICHESKII KOMPLEKS TELEVIZIONNOI BASHNI V OSTANKINO (MOSKVA)]
F. Ya. Klinov 21 May 1971 9 p refs Transl. into ENGLISH from Vdikh SSSR, 1969 p 1–9
(AD-723577; NIC-TRANS-3210) Avail: NTIS CSCL 4/2

At the present time a complex of meteorological observations is being carried out in the lower atmospheric level (500 m) with automatic continuous weather tracking on the 533-meter Ostankino television tower in Moscow. The purpose of the complex is to provide in response to inquiries of the weather service and other organizations meteorological information for separate altitudes in the lower atmospheric level, as well as to provide for the study of weather in conjunction with the ordinary development of meteorological processes and during dangerous conditions, including storms, fog, low cloud levels, squalls, snowstorms, heavy rains and glazed frost-rime phenomena. Author (GRA)

N71-31756# Williams Coll., Williamstown, Mass.
FOURIER ANALYSIS OF WEATHER AND WAVE DATA FROM HOLLAND, MICHIGAN, JULY 1970
William T. Fox and Richard A. Davis, Jr. (Western Mich. Univ., Kalamazoo) 1 May 1971 84 p refs
(Contract N00014-69-C-0151)
(AD-723602; WC-3; TR-3) Avail: NTIS CSCL 4/2

During July, 1970, weather and wave parameters were measured at two hour intervals on the beach and in the nearshore area two miles north of Holland, Michigan. Parameters measured include barometric pressure; wind speed and direction; air and water temperature; sky condition; lake and groundwater level, wave period and height; breaker depth, type, distance and angle; and longshore current velocity. The computer was used to calculate the phase and amplitude for the first 15 Fourier harmonics and to plot the observed data and cumulative curves. The curves were influenced by low pressure systems which passed north of the area of 4, 9, 15 and 19 July. Wave height and direction are related to

cyclonic winds moving counterclockwise around the low pressure system. Longshore current velocity can be predicted as a constant times the derivative of the barometric pressure. Author (GRA)

N71-31781# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).

SYNOPTIC AEROLOGICAL CONDITIONS FOR THE OCCURRENCE OF CLEAR AIR TURBULENCE [DIE SYNOPTISCH-AEROLOGISCHEN BEDINGUNGEN FUER DAS AUFTRETEN VON CLEAR-AIR-TURBULENZ]

F. Weber Bonn Bundeswehramt Aug. 1970 113 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung

(BMWg-FBWT-70-9) Avail: NTIS; Bundeswehramt, Bonn: 25 DM

Bibliography on practical clear air turbulence (CAT) is reported. This is followed by a representation of the results of CAT measurements based on board registrations and observations made by the Deutsche Lufthansa over the North Atlantic and during some other special flights on jet stream conditions. Vertical acceleration and bumpiness has been related to certain meteorological situations and different atmospherical parameters. It follows an illustration of the special synoptical-aerological conditions on which severe or moderate CAT can be expected by means of a demonstration of typical cases and a discussion of statistical studies on the frequency of the occurrence of bumpiness and on the expansion of the zones of turbulence. Author (ESRO)

N71-31822# Fleet Weather Facility, Jacksonville, Fla.

PROJECT STORMFURY: OPERATION ORDER NO. 1-70

Jun. 1970 150 p Revised

(AD-722671) Avail: NTIS CSCL 4/2

The report is the basic directive for the conduct of several types of hurricane/weather modification experiments, utilizing aircraft from the Navy, Air Force and ESSA for STORMFURY operations. These research operations will be initiated, following a dry run training exercise, when a hurricane meets specific scientific and operational criteria. Author (GRA)

N71-31883# Technische Hochschule, Darmstadt (West Germany). Inst. fuer Meteorologie.

THE STRUCTURE OF ATMOSPHERIC TURBULENCE NEAR EARTH'S SURFACE [ZUR STRUKTUR DER BODENNAHEN ATMOSPHAERISCHEN TURBULENZ]

W. Klug *In* DGLR Turbulence Model at Low Altitudes and Flight in a Turbulent Atmosphere Dec. 1970 p 7-20 refs In GERMAN (See N71-31882 19-02)

Avail: NTIS; ZLDI Munich: 34 DM

The structure of the atmospheric turbulence in near-earth air currents is investigated. The discussion is limited to the lowest 100 m of the atmosphere. The influence of the turbulent heat flow on the wind profile is accounted for, and the kinetic turbulent energy and its spectral distribution is calculated. ESRO

N71-31884# Luftwaffenamt, Porz (West Germany). Amt fuer Wehrgeophysik.

A MEASUREMENT SET-UP FOR DETERMINING ATMOSPHERIC TURBULENCE [EINE MESSANLAGE ZUR ERFASSUNG DER ATMOSPHAERISCHEN TURBULENZ]

I. Schmidt *In* DGLR Turbulence Model at Low Altitudes and Flight in a Turbulent Atmosphere Dec. 1970 p 21-28 In GERMAN (See N71-31882 19-02)

Avail: NTIS; ZLDI Munich: 34 DM

A description is given of a tower mounted set-up for measuring low level atmospheric turbulence, wind speed and direction, air temperature, and associated data processing facilities. This equipment is used for assisting in trajectory optimization of unguided artillery rockets. ESRO

N71-31885# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.

SYNOPTIC AEROLOGICAL CONDITIONS FOR THE OCCURRENCE OF CLEAR AIR TURBULENCE [DIE SYNOPTISCH-AEROLOGISCHEN BEDINGUNGEN FUER DAS AUFTRETEN VON CLEAR-AIR-TURBULENZ]

F. Weber *In* DGLR Turbulence Model at Low Altitudes and Flight in a Turbulent Atmosphere Dec. 1970 p 29-54 refs In GERMAN (See N71-31882 19-02)

Avail: NTIS; ZLDI Munich: 34 DM

The results of Lufthansa North Atlantic and European continent jet stream clear air turbulence (CAT) observations are given. Vertical acceleration was related to certain meteorological situations and different atmospheric parameters. Special synoptic aerological conditions during which moderate or severe CAT can be expected are discussed. ESRO

N71-31887# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).

THE SIGNIFICANCE OF TURBULENCE MODELS FOR THE CALCULATION OF THE STANDARD DEVIATION OF BALLISTIC MISSILES [DIE BEDEUTUNG VON TURBULENZMODELLEN ZUR BERECHNUNG DER STREUUNG BALLISTISCHER RAKETEN]

B. Weissenbach *In* DGLR Turbulence Model at Low Altitudes and Flight in a Turbulent Atmosphere Dec. 1970 p 87-97 In GERMAN (See N71-31882 19-02)

Avail: NTIS; ZLDI Munich: 34 DM

The necessity of the availability of low level turbulence models for determining the standard deviation of ballistic missile trajectories is discussed. The mathematical background of missile response to wind effects is given. ESRO

N71-31937# Weather Squadron (24th), Detachment 12, Sheppard AFB, Tex.

TERMINAL FORECAST REFERENCE FILE Final Report

23 Apr. 1971 83 p refs

(AD-723676) Avail: NTIS CSCL 4/2

The reference file discusses factors affecting the weather at Sheppard AFB, Texas. Included are location and topography, weather controls, climatic aids, and special synoptic reminders. Author (GRA)

N71-32002# Joint Publications Research Service, Washington, D.C.

METEOROLOGY

In its Soviet Bloc Res. In Geophys., Astronomy, and Space, No. 256 15 Jul. 1971 p 6-9 refs (See N71-32000 19-30)

Avail: NTIS

Data covering atmospheric and solar phenomena, solar spectra measurements, microstructure measurements of artifical fig, and seasonal variations of semidurnal tidal winds, are given. E.H.W.

N71-32037# Army Natick Labs., Mass. Earth Sciences Lab.

SEASONAL CONTRASTS IN THE EASTERN MOJAVE DESERT

Roland J. Frodigh Aug. 1970 43 p refs

(AD-722738; ES-58; USA-NLABS-TR-70-68-ES) Avail: NTIS CSCL 8/6

Winter and summer seasons in the eastern Mojave Desert are compared in this report, using time-lapse photographic techniques to record seasonal contrasts at nine selected locations. The identical field-of-view from each site, for each season, is printed in full color to realistically portray the differences between the hot and cool periods of the year. Supplementing the photography are narrative descriptions of each landscape, data for the atmospheric conditions at the time of each visit, locational information, and large-scale

planimetric views of the local region in the form of aerial photographs and maps. Also included is an introductory section containing information relative to field techniques and equipment used in developing the study, as well as brief chapters dealing with the climate, topography, and vegetation of the Mojave Desert. Military implications of seasonal changes are emphasized, with comments relative to contrasts in vegetation coloration, visibility, ground surface conditions, and trafficability. Results of this research indicate that there are significant seasonal differences in the physical appearance of much of the desert vegetation in the Mojave Desert. Author (GRA)

N71-32038# Fleet Weather Facility, Jacksonville, Fla.
ANNUAL HURRICANE SUMMARY, 1970 Annual Report
Henry A. Galio, Arthur H. Myers, and Neal R. Meredith 1 Apr. 1971 61 p refs
(AD-722035) Avail: NTIS CSCL 4/2

The report is prepared annually in accordance with COMNAVWEASERVINST 5450.6 to provide tropical cyclone data for the North Atlantic, Caribbean and Gulf of Mexico. The material is presented in three parts. The first part consists of a composite storm track, summary of forecasts issued, and a summary of the 1970 season. The second part includes a narrative, best track chart and maximum wind speed graph for each individual named tropical cyclone. The third part presents, by written summary, graphs and tables, the evaluation of forecasts, and forecasting techniques used during the 1970 season. Also included in this part, for comparison purposes, is an evaluation of data over a period of several years. Author (GRA)

N71-32039# Army Foreign Science and Technology Center, Charlottesville, Va.
PROGRAM DEVICE OF AUTOMATIC CONTROL OF WEATHER RADAR ANTENNA [PROGRAMMNOE USTROISTOVO DIYA AVTOMATICHESKOGO UPRAVLENIYA ANTENNOI MRLS]
A. Ye. Kovalevas et al 16 Mar. 1971 20 p Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 217, 1967
(AD-723298; FSTC-HT-23-1110-70) Avail: NTIS CSCL 17/9

The article analyzes a program device for control of the antenna of a weather radar set. The program device allows horizontal and vertical cross sections of clouds to be produced in a fixed sequence over a broad range of speeds. GRA

N71-32056# North American Weather Consultants, Goleta, Calif.
SANTA BARBARA PYROTECHNIC SEEDING DEVICE TEST PROGRAM 1969-1970 SEASON AND 1967-1970 SUMMARY Final Report
Robert D. Elliott and John R. Thompson Aug. 1970 98 p refs
(Contract N00123-70-C-0243)
(AD-723842; Rept-6-106) Avail: NTIS CSCL 4/2

Tests of the effectiveness of ground-released pyrotechnics in enhancing precipitation have been continued for the third consecutive winter season in the mountains and valleys of Santa Barbara County. A pyrotechnic candle of the LW-83 formulation was ignited just prior to and during the passage of convection bands over the seeding site in the Santa Ynez mountains. The bands were detected upwind of the test area and tracked into the test area by use of telemetered rain gages and weather radar. This years sample consisted of 13 seeded and nine non-seeded bands bringing the three year sample to a total of 43 seeded and 42 non-seeded bands. A computerized seeding area of effect model has been developed and used to predict an envelope of seeding area of effects for the various statistical categories. Author (GRA)

N71-32111# Weather Wing (4th), Ent AFB, Colo.
WEATHER RADAR SCOPE INTERPRETATION
Robert J. Rice, Jr. Apr. 1971 49 p refs *Its* Technical Paper No. 71-1
(AD-723678) Avail: NTIS CSCL 4/2

The paper consolidates many ideas, both published and those of the author, concerning the use of weather radar. Specific emphasis is placed on the interpretation of echoes as they appear on the radar displays. Author (GRA)

N71-32138 National Lending Library for Science and Technology, Boston Spa (England).
THE EFFECT OF THE GROWTH OF MOSCOW ON THE SECULAR VARIATION OF AIR TEMPERATURE
A. A. Dmitriev 24 Jun. 1970 6 p Transl. into ENGLISH from Vestn. Mosk. Univ. Ser. Biol. Pochvoved. Geol. i Geogr. (Moscow), no. 2, 1969 p 98-101
(NLL-M-9257-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Temperature observations from several meteorological stations around Moscow are analyzed. The analysis was made to determine the secular variations of microclimatic air temperature of town-suburb caused by industrial growth. Results show that town temperatures are higher than the surrounding areas because of industrial operations. E.H.W.

N71-32197# National Oceanic and Atomospheric Administration, Boulder, Colo. Environmental Research Labs.
DEVELOPMENT OF AN ECC OZONESONDE
W. D. Komhyr and T. B. Harris Feb. 1971 63 p refs
(AD-723672; APCL-18) Avail: NTIS SOD $0.60 CSCL 4/1

An electrochemical concentration cell (ECC) ozonesonde has been developed for measuring the vertical distribution of atmospheric ozone up to about 35 km. The sondes are normally flown coupled to NOAA National Weather Service or Air Force military type balloon-borne meteorological radiosondes; although, provision has been made in certain models of the instrument for additional coupling to Mastenbrook frost point hygrometers or Suomi-Kuhn net radiometers. This report describes the ozonesondes and their performance characteristics. Specifications for fabricating the instruments, as well as dies and stamping tools used in manufacturing the sondes, have also been developed. Author (GRA)

N71-32347*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A LINEARIZED SOLUTION TO IMPULSIVE LATENT HEAT RELEASE IN A DILUTE, ISOTHERMAL ATMOSPHERE
Igor J. Eberstein (NAS) and Kenneth D. Shere (NOL) Jul. 1971 41 p refs Submitted for publication
(NASA-TM-X-65641; X-651-71-285) Avail: NTIS CSCL 04B

A study is made of the behavior of chemically generated waves in a simplified atmosphere. The atmosphere is assumed unbounded, isothermal, one-space-dimensional and initially quiescent. At an initial time a dissociation reaction, AB + J yields A + B + J, commences and drives the subsequent wave motion. The fraction of reactant in the atmosphere, X sub 0, is assumed to be small. The system of governing equations is then expanded in terms of the small parameter, X sub 0, and an asymptotic integral solution as X sub 0 yields 0 is obtained. The solution is integrated numerically for several natural impulsive heat releases, including thunderstorms, hurricanes, chemical reactions, and aurorae. Strong thunderstorms and hurricanes are found to induce considerable vertical motion and large temperature changes in the upper atmosphere. The same is true for auroral heat releases. Conversely, upper atmosphere effects of changes in the ozone layer appear to be small. Author

N71-32383 Texas A&M Univ., College Station.
ANOMALOUS WINTERTIME PRECIPITATION IN THE WESTERN UNITED STATES AND RELATED METEOROLOGICAL VARIABLES

Lalovee Glendale Cobb (Ph.D. Thesis) 1970 173 p
Avail: Univ. Microfilms Order No. 70-16719

Significant anomalies are presented of monthly precipitation in the western United States which are related to (1) anomalies of sea-surface temperatures in the eastern North Pacific Ocean, (2) anomalous flow associated with departures from normal sea-level pressure, and (3) differences in the flux of moisture. Examples are given showing that large-scale anomalies of temperatures of the ocean surface are coherent, making detection from month to month possible; these anomalies greatly influence the circulation of the overlying atmosphere and, in turn, are influenced greatly by the ever-changing atmospheric flow. The underlying ocean controls the development of large cyclones and anticyclones that persist for weeks, months, and even seasons by being a main source of moisture and energy. Anomalous geostrophic flow, related to departures from normal monthly sea-level pressure, are shown to be related closely to the distribution of anomalies of precipitation during the winter wet seasons. Dissert. Abstr.

N71-32397# Chicago Univ., Ill. Dept. of Geophysical Sciences.
ESTIMATE OF MAXIMUM WIND SPEEDS OF TORNADOES IN THREE NORTHWESTERN STATES
T. Theodore Fujita Dec. 1970 32 p refs
(Grants NOAA-E22-24-71(G); NOAA-E22-69-70(G))
(SMRP-92) Avail: NTIS

In an attempt to estimate the maximum wind speeds of potential tornadoes expected in three northwestern states, all tornadoes and funnel clouds reported in Storm Data during a 20 year period, 1950 through 1969, were examined. Each storm was reevaluated using a method of "tornado characterization" based upon the intensity and area of each storm. Combined analyses of the distribution of characterized tornadoes and hailstorms revealed the existence of tornado alleys and hail swaths in the three state area. It was concluded that the maximum speed of inswath tornadoes ranges between 200 and 225 mph, and that a maximum wind speed of 175 mph seems to be a conservative figure for tornadoes elsewhere. Expected maximum values of the pressure drop of 1.5 psi and time change of 0.5 psi per sec in pressure of 200-mph tornadoes were also estimated. Author

N71-32404# Illinois State Water Survey, Urbana.
ILLINOIS TORNADOES
John W. Wilson and Stanley A. Changnon, Jr. 1971 61 p refs
(PB-198280; Circ-103) Avail: NTIS CSCL 04B

The climatology of Illinois tornadoes is presented based on data from the 1916–1969 period, including a variety of general interest tornado facts. Five of the outstanding Illinois tornado days of the 1916–1969 period are discussed in detail, including the famed Tri-State tornado of 18 March 1925, the most devastating tornado in the United States since systematic collection of tornado data began in 1916. The general information includes, among other items, basic definitions pertinent to tornadoes, safety precautions, formulation of a tornado forecast, and methods for remote detection of tornadoes. Author (GRA)

N71-32407# RAND Corp., Santa Monica, Calif.
CALCULATION OF THE TERMINAL VELOCITY OF WATER DROPS
Hermann B. Wobus (Navy Weather Res. Facility), F. W. Murray, and L. R. Koenig Jan. 1971 13 p refs
(P-4564) Avail: NTIS

Three mathematical expressions for terminal velocity of water drops in still air as a function of equivalent radius are compared with the experimental data of Gunn and Kinzer. Two of them, derived by curve-fitting techniques, give excellent results over the full range of meteorological interest, including the Stokes's Law regime. A formula to correct non-standard pressure and temperature is given, and its results are compared with the experimental data of Beard and Pruppacher. Author

N71-32446# National Academy of Sciences-National Research Council, Washington, D.C.
THE LUBBOCK STORM OF MAY 11, 1970
J. Neils Thompson, Ernst W. Kiesling, Joseph L. Goldman, Kisho C. Mehta, and John Whittman, Jr. 1970 82 p refs
(Grant NSF C310)
(PB-198377) Avail: NTIS CSCL 04B

The results of an engineering and meteorological survey which began immediately after the Lubbock storm of May 11, 1970 are reported. It is intended to be of use in the evaluation of studies and rehabilitation projects now underway or projected in Lubbock, and also in more general investigations of the adequacy of current building practices under extreme weather conditions such as those of a tornadic storm. Author (GRA)

N71-32503# Joint Publications Research Service, Washington, D.C.
OBSERVATION OF NOCTILUCENT CLOUDS FROM SPACE
K. Ya Kondrat'yev et al 1 Jul. 1971 7 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 197, no. 5, 1971 p 1066–1069
(JPRS-53508) Avail: NTIS

Noctilucent clouds are easily visible from space against the background of the twilight segment. When noctilucent clouds are observed from space orbit, their spatial structure is visible, and their appearance changes markedly as the spaceship continues in its orbit. The noctilucent clouds observed from space have details of a somewhat different kind than when observed from ground stations. Author

N71-32506+ National Center for Atmospheric Research, Boulder, Colo.
RAWINSONDE DATA OBTAINED DURING THE LINE ISLANDS EXPERIMENT. VOLUME 1: DATA REDUCTION PROCEDURES AND THERMODYNAMIC DATA
R. Madden, E. Zipser, E. Danielsen, D. Joseph, and R. Gall Feb. 1971 348 p refs Sponsored by NSF
(NCAR-TN/STR-55-Vol-1) Avail: NTIS HC$8.00

A detailed description is presented of the rawinsonde data obtained at Palmyra, Fanning, and Christmas Islands (all low coral atolls), and from the USC and GSS Surveyor. A discussion of the data reduction techniques used, a listing of other formats in which the upper air data are available, and the actual thermodynamic data from over 800 soundings taken during the Line Islands experiment are included. The data represent a carefully processed, short-term record of upper air temperature, moisture, and winds near the equator. Author

N71-32507+ National Center for Atmospheric Research, Boulder, Colo.
RAWINSONDE DATA OBTAINED DURING THE LINE ISLANDS EXPERIMENT. VOLUME 2: WIND DATA
R. Madden, E. Zipser, E. Danielsen, D. Joseph, and R. Gall Feb. 1971 312 p Sponsored by NSF
(NCAR-TN/STR-55-Vol-2) Avail: NTIS HC$8.00

Upper level wind data are presented from soundings made at Palmyra, Fanning, and Christmas Islands and from aboard the USC and GSS Surveyor. Detailed low level wind data are also given. Author

N71-32556# RAND Corp., Santa Monica, Calif.
SOME ECONOMIC ASPECTS OF RAIN STIMULATION
R. R. Rapp Dec. 1970 13 p refs Presented at ASME meeting, Phoenix, Ariz., 11-14 Jan. 1971
(P-4524) Avail: NTIS

An economic analysis is presented on weather modification for increased rainfall over Israel to increase the stored water supply and the amount of water available for irrigation. Annual rainfall

distribution, normal precipitation for eastern Mediterranean countries, and the water supply distribution of Israel are given in graphical representations. J.A.M.

N71-32558# Chicago Univ., Ill. Dept. of the Geophysical Sciences.
ESTIMATE OF AERAL PROBABILITY OF TORNADOES FROM INFLATIONARY REPORTING OF THEIR FREQUENCIES
Tetsuya T. Fujita Oct. 1970 26 p refs
(Grant NOAA-E22-67-70(G))
(SMRP-89) Avail: NTIS

During the past half century, the reported annual tornado frequency increased by one order of magnitude, from less than 100 to almost 1,000, giving the impression that tornado probability in the United States had increased continuously. Computation of frequency deviation from 5-year running averages showed a random deviation of up to 50% from the 5-year average frequencies, thus reaching the conclusion that the inflationary frequencies are a result of ever improving tornado reporting systems. Based upon individual tornado areas as derived from Storm Data, tornadoes were classified into four categories: Giant, Regular, Meso and Micro tornadoes. It was found that over 50% of the total tornado areas were caused by Giant tornadoes which represent only about 3% of the total frequency and that Micro tornadoes, about 40% of the total frequency, accounted for only 1% of the total tornado areas. Finally, the aereal probability of tornadoes was computed to determine the probability that a spot will be affected by a tornado. Author

N71-32578# Lockheed Missiles and Space Co., Palo Alto, Calif.
INVESTIGATION OF THE ATMOSPHERE BY MEANS OF THE INTRINSIC RADIO-THERMAL EMISSION ON THE KOSMOS-243
A. M. Obukhov et al 1971 8 p refs Transl. into ENGLISH from Kosmich. Issled. (USSR), v. 9, no. 1, 1971 p 66–73
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Geophysical results obtained in the Cosmos-243 experiment are summarized. The method of calibrating the onboard apparatus according to average climate data is described. On the basis of a comparison between satellite and radiosonde measurements of the total humidity, the accuracy of the satellite measurements is estimated to be 0.2 g/sq cm. Statistical estimates of the latitude and time distributions are given for the water vapor and droplets over the oceans. Histograms are presented for the brightness temperatures at 1.35 and 0.8 cm wavelengths, and it is shown that approximately 1% of the water in the atmosphere is in the liquid drop state. Author

N71-32578*# Michigan Univ., Ann Arbor.
ATMOSPHERIC EFFECTS ON INFRARED MULTISPECTRAL SENSING OF SEA-SURFACE TEMPERATURE FROM SPACE
D. Anding, R. Kauth, and R. Turner Washington NASA Jul. 1971 103 p refs
(Contract NAS12-2117)
(NASA-CR-1858) Avail: NTIS CSCL 04B

The effect of the atmosphere on the infrared spectral radiance emanating from the sea surface is defined. The application of multichannel infrared remote sensing as a means of compensating for these atmospheric effects to obtain improved estimates of the sea temperature from high-altitude or space platforms is also discussed. It is demonstrated that by performing simultaneous radiometric measurements in three narrow spectral intervals centered at 4.9, 9.1, and 11.0 microns, the effects of noncloudy atmospheres on the observed radiance can be nearly completely compensated for and estimates of sea temperature to an accuracy of 0.15 K can be obtained. For fields of view which contain clouds, the three-channel radiometric data also provide the necessary information to indicate the presence of semitransparent or opaque clouds within the field of view and, if opaque, the fractional amount of cloud obscuration to an accuracy of approximately 10% for any field-of-view size. Author

N71-32587 National Lending Library for Science and Technology, Boston Spa (England).
A HEURISTIC APPROACH TO THE ASSESSMENT OF METEOROLOGICAL FORECASTS
M. G. Ter-Mkrtcjan 24 Jun. 1970 5 p ref Transl. into ENGLISH from Glav. Uprav. Gidromet. Sluz., Met. Gidr. (Leningrad), no. 12, 1969 p 94–95
(NLL-M-9255-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Factor analysis techniques are utilized in a heuristic approach to an assessment matrix for a three-phase meteorological forecast. Author

N71-32588# Deutscher Wetterdienst, Hohenpeissenberg (West Germany). Meteorologisches Observatorium.
RESULTS OF AEROLOGICAL OZONE SOUNDINGS AT THE HOHENPEISSENBERG METEOROLOGICAL OBSERVATORY, PART 8 Final Report, Jul. – Dec. 1970
Walter Attmannspacher Apr. 1971 165 p
(Contract DAJA37-67-C-0317)
(AD-723487; ARDG(E)-E-1093-Pt-8) Avail: NTIS CSCL 4/1

These special reports represent a mass of data in tabular and map form taken in Hohenpeissenberg for 1970, taken at different levels during the passage of storms and fronts. Included are: ozone tables and ozonagrams; tables and ascent data including those for temperatures, pressures and wind aloft. Author (GRA)

N71-32631# Deutscher Wetterdienst, Hohenpeissenberg (West Germany). Meteorologisches Observatorium.
RESULTS OF AEROLOGICAL OZONE SOUNDINGS AT THE HOHENPEISSENBERG METEOROLOGICAL OBSERVATORY, PART 6 Final Report, Jul. – Dec. 1969
Walter Attmannspacher Oct. 1970 165 p
(Contract DAJA37-67-C-0317)
(AD-723437; ARDG(E)-E-1093-Pt-6) Avail: NTIS CSCL 4/1

These special reports present a mass of data in tabular and map form taken at Hohenpeissenberg for 1969, taken at different levels during the passage of storms and fronts. Included are: ozone tables and ozonagrams; tables and ascent data including those for temperatures, pressures and winds aloft. Author (GRA)

N71-32682# Naval Weather Service Command, Washington, D.C.
SUMMARY OF SYNOPTIC METEOROLOGICAL OBSERVATIONS: HAWAIIAN AND SELECTED NORTH PACIFIC ISLAND COASTAL MARINE AREAS. VOLUME 1: AREA 1, HAWAIIAN WINDWARD, AREA 2, HAWAIIAN LEEWARD, AREA 3, BARKING SANDS, AREA 4, FRENCH FRIGATE SHOALS
Jun. 1971 642 p
(AD-723798) Avail: NTIS HC $9.00/MF $0.95 CSCL 4/2

The data contained in these tables were obtained from tape data Family 11 (TDF-11), Marine Surface observations. TDF-11 was primarily funded by the Naval Weather Service Command and selected by NWSED Asheville as the most comprehensive collection of marine surface observations from which to develop a series of coastal marine summaries. The areas discussed in this volume include Hawaiian Windward, Hawaiian Leeward, Braking Sands and French Frigate Shoals. Author (GRA)

N71-32722+ International Geophysical Year World Data Center A, Washington, D.C.
METEOROLOGY: HIGH ALTITUDE METEOROLOGICAL DATA, DECEMBER 1969, VOLUME 6, NO.12
1971 197 p
Avail: NTIS

Wind and temperature measurements from all available meteorological sounding rocket firings are presented, along with computed values for pressure, density, and speed of sound. Local radiosonde observations nearest the time of firing are included. Author

N71-32724# RAND Corp., Santa Monica, Calif.
SUGGESTIONS (RESURRECTED) FOR THE IMPROVEMENT OF SHORT-RANGE WEATHER FORECASTING
R. E. Huschke Mar. 1971 12 p
(P-4580) Avail: NTIS

Five basic aspects of the forecast problem are discussed and suggestions made. The aspects covered are the nature of the ideal forecast and forecasting technique, the problem of specification, the factor of human talent, and the recognition of customer needs. Author

N71-32734*# National Oceanic and Atmospheric Administration, Rockville, Md. BOMAP Office.
BOMEX ATMOSPHERIC MASS AND ENERGY BUDGETS: PRELIMINARY RESULTS
Eugene M. Rasmusson *In its* BOMEX Bull., No. 10 Jun. 1971 p 44–50 ref (See N71-32731 19-34)
Avail: NTIS

Analyses of mass, momentum, and energy budgets of the atmosphere within a defined ocean surface area near Barbados are performed by a series of trial integral computations based on rawinsonde observations. A vertical resolution of 10 mb is used in computations from the surface to 500 mb above the surface in a p* coordinate system, where p* is the position on the vertical axis in terms of pressure differential relative to sea level. The diurnal variation of humidity in the basic data is removed. Resulting mass and water budgets for 5 day average water balance components show that the vertical eddy flux decreases slowly with height through the first 80 mb, then more rapidly during upward motion into a zone of temperature stability. The largest values of eddy flux convergence are found in a 170 to 220 mb region which corresponds to the layer of greatest stability in the mean sounding. The net vertical flux is upward in the lowest mb, where the upward eddy flux is dominant; above this level, the flux accomplished by the mean downward motion, dominates. G.G.

N71-32735*# National Oceanic and Atmospheric Administration, Rockville, Md. BOMAP Office.
THREE DIMENSIONAL MODEL OF PRECIPITATION ECHOES FOR X-BAND RADAR DATA COLLECTED DURING BOMEX
Michael D. Hudlow *In its* BOMEX Bull., No. 10 Jun. 1971 p 51–62 refs (See N71-32731 19-34)
Avail: NTIS

A quantitative statistical model is developed that describes the three dimensional geometry and intensity of a radar echo, given a one dimensional parameter of the echo to serve as the independent estimator. The maximum dimension of a radar echo, recorded at a 0 deg tilt angle, constitutes a significant estimator of other echo parameters. The importance of radar echo statistics for parameterizing the morphology of mesoscale precipitation is pointed out and echo length as one important statistic is stressed. As revealed by the echo model, a major portion of the precipitation content, contained in a horizontal slice of the radar echo, is distributed over a relatively small portion of the total area of the radar echo. The precipitation spectrum giving the quantity of precipitation deposited within an area of interest by precipitation echoes of various sizes peaks at an echo length of about 30 mi. Also, it is found that echo sizes less than 10 mi contribute only about 5 percent to the precipitation deposited. Author

N71-32736*# National Oceanic and Atmospheric Administration, Rockville, Md. BOMAP Office.
A TECHNIQUE FOR ASSESSING PROBABLE DISTRIBUTIONS OF TROPICAL PRECIPITATION ECHO LENGTHS FOR X-BAND RADAR FROM NIMBUS 3 HRIR DATA
Wolfgang D. Scherer and Michael D. Hudlow *In its* BOMEX Bull., No. 10 Jun. 1971 p 63–68 refs (See N71-32731 19-34)
Avail: NTIS

A three dimensional precipitation echo model is used for simulating radar echoes from Nimbus 3 satellite high resolution infrared data to an extended ocean surface area. Echo lengths and their numbers are estimated and their contributions to precipitation estimates are calculated. Presented results for calculations where radar and satellite data are used match predicted total echo areas and agree well with actual observations. However, there is a proportionally larger difference between the total number of predicted echoes and the total number of observed echoes. This disagreement is caused partly by the inadequate number of cases analyzed for the derivation of echo length frequency distributions and the relationship linking statistically the area and length of a radar echo. G.G.

N71-32737*# National Oceanic and Atmospheric Administration, Rockville, MD. BOMAP Office.
ANALYSIS OF RADIOSONDE HUMIDITY ERRORS BASED ON BOMEX DATA
H. L. Crutcher, L. D. Sanders, and J. T. Sullivan *In its* BOMEX Bull., No. 10 Jun. 1971 p 68–76 refs (See N71-32731 19-34)
Avail: NTIS

Radiosondes and dropsondes currently used in the United States yield incorrect humidities for several reasons. For the radiosonde these include the effects of solar radiation during the day, inadequate ventilation, and thermal lag in the hygristors. For the dropsonde, the error is due mainly to thermal lag. Lag corrective procedures have been established, and tentative lag constants determined. Results appear to be satisfactory. Author

N71-32763*# National Oceanic and Atmospheric Administration, Rockville, Md.
SAMPLES AND FORMAT OF REDUCED DATA
In its BOMEX Bull., No. 8 Oct. 1970 p 41–64 (See N71-32760 19-34)
Avail: NTIS CSCL 04B

Digitization of BOMEX data reduction and processing is discussed. Dropsonde and rawinsonde fixed ship data is used, along with boom and surface data for analysis of sea surface and air interactions. A radiometersonde was used to measure temperature and infrared heating rate profiles. The primary set of oceanographic data consists of 1400 salinity-temperature-depth casts. The boundary layer instrument package system consisted of tethered, blimplike ballons flown from fixed ships for measuring dry and wet bulb temperature, pressure, and wind speed. J.A.M.

N71-32769# Weather Squadron (24th), Detachment 8, Chanute AFB, Ill.
TERMINAL FORECAST REFERENCE FILE, CHANUTE AFB, ILLINOIS Final Report

5 Apr. 1971 87 p refs
(AD-723673) Avail: NTIS CSCL 4/2

The reference file discusses factors affecting the Weather at Chanute AFB, Illinois. Included are location and topography, weather controls, climatic aids, and local forecast studies. Author (GRA)

N71-32791*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SEASONAL AND GEOGRAPHIC VARIATION OF ATMOSPHERIC OZONE, DERIVED FROM NIMBUS 3
C. Prabhakara, B. J. Conrath, L. J. Allison, and J. Steranka Washington Aug. 1971 63 p refs
(NASA-TN-D-6443; G-1027) Avail: NTIS CSCL 04B

Nimbus 3 infrared interferometer spectrometer measurements of the intensities in the 9.6 microns region are used to derive the ozone content in the atmosphere between latitudes 80 N and 80 S. The global distribution of total ozone was mapped for eight days in April and eight days in July 1969. These global maps of total ozone are compared with the upper-air constant-pressure maps to emphasize the meteorological significance of the ozone variations in time and space. Author

N71-32798*# Pennsylvania State Univ., University Park.
STATISTICAL PROPERTIES OF TURBULENCE AT THE KENNEDY SPACE CENTER FOR AEROSPACE VEHICLE DESIGN
J. A. Dutton, H. A. Panofsky, D. C. Deaven, B. R. Kerman, and V. Mirabella Washington NASA Aug. 1971 67 p refs
(Contract NAS8-21140)
(NASA-CR-1889) Avail: NTIS CSCL 04B

The statistical properties of turbulence at the Kennedy Space Center as related to the design of aerospace vehicles are discussed, along with four major topics of boundary layer flows, namely, (1) the simulation of atmospheric turbulence with empirical orthogonal functions, (2) the estimation of co- and quad-spectra, (3) the estimation of viscous dissipation, and (4) estimation of the variances of turbulence. Author

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N71-31641# Beukers (John M.) Labs., Inc., Medford, N.Y.
THE PRACTICAL APPLICATION OF LORAN C RADIO SIGNALS TO THE PRECISION LOCATION AND TRACKING OF REMOTE OBJECTS
John M. Beukers and James I. Meranda *In* Kentucky Univ. Proc. of 1970 Carnahan Conf. on Electron. Crime Countermeas. Apr. 1970 p 137–140 (See N71-31628 19-10)
Avail: NTIS

A practical means for using existing long range radio navigation signals (Omega and loran-C) to determine the position of remote objects is described. It consists of mounting a small radio retransmitter on the object. The retransmitter does nothing more than relay the navigation signal to some remote point where the more complex measurements are made to determine the object's position. The prospects of applying the same principle to the tracking of objects other than weather balloons are indicated. Author

N71-31794# Alabama Univ., Huntsville. Research Inst.
OUTLINE OF STABILITY ANALYSIS, VOLUME 1 Final Technical Report
H. J. Brauchli Apr. 1971 47 p refs
(Contract DAAH01-69-C-0419)
(AD-723419) Avail: NTIS CSCL 17/7

The modified Euler equations are formulated for a gyroscope on gimbal rings mounted on a moving vehicle, the mass and inertial moments of the inner gimbal ring being variable. In a first approximation, the governing differential equations of the system are close in behavior to Hills equation. Some simple models are discussed in detail. In general, no reliable conclusions on the behavior regarding finite time stability and practical stability of the actual system may be drawn from this analysis. A numerical method applicable to a broad class of systems is proposed to obtain directly the stability domain in parameter space as well as numerical bounds for practical stability over a finite time interval. The first step is based on an application of the invariant imbedding approach, the second on integrating the governing differential equation with a random excitation. Author (GRA)

N71-31799# Alabama Univ. Research Inst., Huntsville.
GENERAL FORMULATION AND COMPUTER PROGRAM, VOLUME 2
R. R. Reed Apr. 1971 50 p
(Contract DAAH01-69-C-0419)
(AD-723420) Avail: NTIS CSCL 17/7

General expressions for the angular momenta of the various parts of the TAG (Thrust Alleviated Gyroscope) are derived, including effects of mass unbalance and misalignment. The general equations of motions of the gyro are formulated, assuming the motion of the missile will be given. These are then simplified to an Ideal Gyro. A general computer program for integrating the resulting system of differential equations is provided, along with results for the motion of the TAG under simulated missile motions. Author (GRA)

N71-32065# Center for Naval Analyses, Arlington, Va. Inst. of Naval Studies.
A SIMULATION AND QUEUING MODEL FOR THE STUDY OF EN ROUTE AIR TRAFFIC SYSTEMS
Leon M. Kaatz Feb. 1971 49 p refs *Its* Res. Contrib. No. 169
(AD-721726) Avail: NTIS CSCL 17/7

Air traffic congestion at airports and along major jet routes are the primary sources of concern with the airspace system. This paper describes 2 related mathematical models to study these problems. The first model is a simulation of en route traffic. It defines a quantity called the congestion index and relates this to the level of air traffic and the level of investment in the airspace system. The second model is a queuing model used to study congestion and average flight delays at points of jet route intersections. The models consider only high altitude IFR flights but allow for parameterization of plane speeds, separation criteria, available jet routes, and airport operations capacity. The models do not look at holding and takeoff patterns around an airport. Author (GRA)

N71-32084# National Aviation Facilities Experimental Center, Atlantic City, N.J.
EVALUATION OF FLIGHT PLAN, POSITION INFORMATION DISPLAY FOR OCEANIC CONTROL Final Report, May 1970–Jan. 1971
Anthony J. Spingola, W. Robert McCosker, and Richard L. Sulzer Jul. 1971 50 p refs
(FAA-NA-71-21; FAA-RD-71-38) Avail: NTIS

Tests were conducted using flight data paralleling that entering oceanic sectors to evaluate the concept and measure the accuracy of using computer generated flight plan position information as presented on pictorial and tabular displays for oceanic air traffic control. Actual flight progress strip data were tabulated to show the relations among flight plans, estimated times of arrival updated en

route, and actual times of arrival over fixes. Experienced oceanic controller teams were trained in the use of an interactive graphic display system. Results of the analysis of flight progress strips indicated that the standard deviation of differences between pilot estimated times at reporting fixes and actual time taken at 515 data points was 3.2 minutes. Author

N71-32085# National Aviation Facilities Experimental Center, Atlantic City, N.J.
A 1585 MHz GLIDE SLOPE SYSTEM Final Report, Sep. 1967 – Nov. 1970
John E. Townsend Aug. 1971 31 p
(FAA-NA-71-15; FAA-RD-71-50) Avail: NTIS

Test and evaluation of a glide slope system operating in the 1585 MHz frequency range were conducted. The system uses a directional waveguide antenna that forms beams in space that are independent of ground reflections. Based on the data obtained from the tests performed, it was determined that a glide slope operating in the 1585 MHz frequency range is feasible, but certain improvements are necessary to the present system to make it operational. Author

N71-32268 Pennsylvania Univ., Philadelphia.
SPACECRAFT ATTITUDE MEASUREMENT USING SPATIAL COHERENCE OF LASER AND STAR LIGHT
Anthony Burton De Cou (Ph.D. Thesis) 1969 78 p
Avail: Univ. Microfilms Order No. 70-16137

The possibility was investigated of using the spatial coherence properties of laser or star light to make highly accurate determinations of the attitude of a spacecraft around any axis perpendicular to the direction of propagation of the reference light used. An interferometer was used to compare the phase of the radiation arriving at two widely separated points on the space vehicle. The phase difference at these points is directly proportional to the attitude around the axis perpendicular to the direction of propagation and the line joining the two sample points. The energy requirements of the laser beacon necessary to overcome background radiation noise were determined for the system. The deterioration of the optical properties of laser light propagating vertically through the atmosphere was examined. The feasibility of using star light instead of laser light as a reference is examined, and some of the problems connected with such a system are considered. Dissert. Abstr.

N71-32287 Pennsylvania Univ., Philadelphia.
DESIGN OF AIDED STRAPDOWN INERTIAL NAVIGATION SYSTEMS
James Warren Murrell (Ph.D. Thesis) 1969 428 p
Avail: Univ. Microfilms Order No. 70-16191

The design of an aided, long duration, strapdown inertial navigation system was investigated. A Kalman filter was used to process the aiding system's information to estimate the strapdown system's errors. A linear error model that is satisfactory for implementation in a Kalman filter was developed. Using the model, a statistical error analysis of the unaided strapdown system was performed. The Kalman filter equations for a general partitioned system configuration were derived and then applied to two special cases. Reference or baseline position aided and velocity aided strapdown systems were defined and their performance analyzed. Equations that determine the sensitivity of the Kalman filter to modeling errors were derived and used to perform a sensitivity analysis of the position aided system. The ability of the Kalman filter to process aiding system information and reduce the strapdown system's errors to reasonable levels was demonstrated. Dissert. Abstr.

N71-32428*# Control Data Corp., Minneapolis, Minn.
JOINT DETERMINATION OF ORBITS OF SPACECRAFT AND MOONS OF MARS BY OPTICAL SIGHTING OF THE MOONS
Charles B. Grosch and Donald F. Nickel Washington NASA Jul. 1971 142 p refs
(Contract NAS1-9617)
(NASA-CR-1805; RD-2013) Avail: NTIS CSCL 17G

The feasibility of using a scanning optical system to provide the attitude and trajectory of an unmanned spacecraft during an orbit about Mars is investigated. It is assumed that the spacecraft is nearly attitude stabilized by a Sun-Canopus Tracking System. The scanning instrument yields a more accurate determination of its attitude by use of stellar detections across three slits. The same slits occasionally detect transits of the Martian moons, and these transits together with the stellar transits are sufficient to yield the trajectories of the moons and spacecraft as well as the higher harmonic coefficients of the Martian gravitation potential. The accuracy with which the attitude, trajectories, and potential can be determined from the measurements is studied. Also, an analysis of the perturbations of the spacecraft's position due to the moon's force fields is given. Finally, the instrument detection problems are discussed and instrument design parameters are derived. Author

N71-32677*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
PROJECT/SPACE SHUTTLE: SPACE SHUTTLE GUIDANCE, NAVIGATION AND CONTROL DESIGN EQUATIONS, VOLUME 1
15 Apr. 1971 34 p refs
(NASA-TM-X-67218; MSC-04217-Vol-1) Avail: NTIS CSCL 17G

The initial specifications of the equations necessary to perform the guidance, navigation, and control onboard computation functions are presented. Introductory information is given on definition of terms, reference documents, system description, software functional requirements, and coordinate systems and transformations. N.E.N.

N71-32678*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
PROJECT/SPACE SHUTTLE: SPACE SHUTTLE GUIDANCE, NAVIGATION AND CONTROL DESIGN EQUATIONS, VOLUME 2: PREFLIGHT THROUGH ORBIT INSERTION
15 Apr. 1971 58 p refs
(NASA-TM-X-67217; MSC-04217-Vol-2) Avail: NTIS CSCL 17G

Current data on the specifications of the equations for GN and C of the space shuttle orbiter are presented. Initial information is given on equations for the preflight, boost, separation, orbit insertion, and ascent abort phases. N.E.N.

N71-32679*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
PROJECT/SPACE SHUTTLE: SPACE SHUTTLE GUIDANCE, NAVIGATION AND CONTROL DESIGN EQUATIONS, VOLUME 3: ORBITAL OPERATIONS
15 Apr. 1971 227 p refs
(NASA-TM-X-67215; MSC-04217-Vol-3) Avail: NTIS CSCL 17G

Initial details and flow charts are given for the equations for orbital operations of the orbiter. These include orbital coast, orbital powered flight, rendezvous, station keeping, docking and undocking, and docked operations phases. N.E.N.

N71-32680*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MESS (MISALIGNMENT ESTIMATION SOFTWARE SYSTEM) FOR IN-FLIGHT ALIGNMENT AND CALIBRATION OF SPACECRAFT ATTITUDE SENSORS
R. Desjardins Jul. 1971 51 p refs Presented at Astrodynamics Specialists Conf., Ft. Lauderdale, Fla., 17-19 Aug. 1971

(NASA-TM-X-65667; AAS-71-357; X-514-71-323) Avail: NTIS CSCL 17G

A system known as MESS (misalignment estimation software system) was designed for the OAO satellite for inflight calibrations of slew angle scale factors and drift rates of the gyros. Attitude sensor errors arising from preplanned spacecraft activity are returned to the OAO support computer data base. Then the MESS subroutine system correlates these errors with the spacecraft activity and processes these data to arrive at estimates of the sensor alignment and calibration parameter values which caused the errors. MESS then automatically computes correction factors for the computer model of the spacecraft, so that subsequent spacecraft commands will reflect compensations for the misalignments and calibration deviations detected. Author

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N71-31705# Oak Ridge National Lab., Tenn. Neutron Physics Div.

APPLICATION OF DOT-MORSE COUPLING TO THE ANALYSIS OF THREE-DIMENSIONAL SNAP SHIELDING PROBLEMS

E. A. Straker, R. L. Childs, and M. B. Emmett 1 Apr. 1971 24 p refs Presented at the Natl. Symp. on Natural and Manmade Radiation in Space, Las Vegas, Nev., 1-5 Mar. 1971

(Contract W-7405-eng-26)

(ORNL-TM-3365; Conf-710304-6) Avail: NTIS

Many radiation transport problems can best be solved by using both discrete ordinates and Monte Carlo techniques with a coupling between the two techniques occurring at a geometry interface. A general discussion of two possible coupling schemes is given. The calculation of the reactor radiation scattered from a docked service and command module is used as an example of coupling discrete ordinates (DOT) and Monte Carlo (MORSE) calculations. Author (NSA)

N71-31711# General Electric Co., Sunnyvale, Calif. Breeder Reactor Development Operation.

REACTOR PRIMARY COOLANT SYSTEM RUPTURE STUDY Quarterly Report, Oct. – Dec. 1970

Jan. 1971 62 p

(Contract AT(04-3)-189)

(GEAP-10207-23; QR-23) Avail: NTIS

Fatigue tests and probability analysis of pipe failure in boiling water reactor cooling systems are reported including the effects of low-cycle fatigue on crack initiation and propagation in carbon steel and Type-304 stainless steel pipes and failure mechanisms in the cooling pipes. J.M.

N71-31734# General Electric Co., Sunnyvale, Calif.

SOUTHWEST EXPERIMENTAL FAST OXIDE REACTOR DEVELOPMENT PROGRAM Quarterly Report, Nov. 1970–Jan. 1971

G. R. Pflasterer and R. A. Becker, comps. Feb. 1971 71 p refs

(Contract AT(04-3)-540)

(GEAP-10010-27; QR-7) Avail: NTIS

The SEFOR, designed for the systematic determination of the Doppler coefficient of reactivity at temperatures up to the vicinity of fuel melting, is discussed. Also discussed are fabrication procedures for plutonium and uranium oxide pellets and the inspection techniques used. Physics measurements for the two fuels are also given. E.H.W.

N71-31735# Argonne National Lab., Ill.

VENUS: TWO-DIMENSIONAL COUPLED NEUTRONICS HYDRODYNAMICS COMPUTER PROGRAM FOR FAST REACTOR POWER EXCURSIONS

W. T. Sha and T. H. Hughes Oct. 1970 117 p refs

(Contract W-31-109-eng-38)

(ANL-7701) Avail: NTIS

A new computational model for fast reactor disassembly analyses is presented. The model utilizes the space independent neutronics, two dimensional (RZ) Lagrangian hydrodynamics, and an energy-density-dependent equation of state. The reactivity feedbacks due to Doppler broadening and material motion are explicitly taken into account. This model can analyze both high and low density systems in contrast with the modified Bethe–Tait methods, which are valid only for the low density systems. A unique feature of this model is its pointwise description of core material contents so that an appropriate equation of state corresponding to sodium-in and sodium-out conditions can be assigned. Another is its rigorous treatment of implosion effects at any arbitrary boundary surface, such as a void region surrounded by a nonvoid region or at the interface of two regions of a zoned core. The total energy release during a nuclear excursion calculated from this model is much lower than the values obtained from the modified Bethe–Tait methods. Author (NSA)

N71-31764# Argonne National Lab., Ill. Applied Physics Div.

ZPR-3 ASSEMBLIES 48, 48A, AND 48B: THE STUDY OF A DILUTE PLUTONIUM FUELED ASSEMBLY AND ITS VARIANTS

A. M. Broomfield (United Kingdom Atomic Energy Authority, Winfrith, Engl.), A. L. Hess, P. I. Amundson, Q. L. Baird (Battelle Northwest Lab.), E. F. Bennett et al Dec. 1970 163 p refs

(Contract W-31-109-eng-38)

(ANL-7759) Avail: NTIS

ZPR-3 Assembly 48 and its variants which were relatively simple and small Pu-fueled fast critical systems were studied. All the cores were composed with plates of Pu diluted with plates of depleted U, Na, and graphite, in addition to the necessary steel drawers and matrix tubes. In Assembly 48, the atomic ratio of U to Pu in the core was approximately 4:1, with the Pu-240 isotopic fraction of 6%, and the blanket was 12 in. of depleted U. Assembly 48A had the same core composition, except that part of the radial blanket was replaced by an Inconel reflector. Worths of simulated B4C control rods were measured in the Inconel reflector. In Assembly 48B, the core contained a small central zone where the Pu-240 isotopic content in the Pu was raised to an average of approximately 17%. The program of Assembly 48 experiments described includes the measurements of critical masses, central fission ratios, central reactivity coefficients, heterogeneity effects, Na-voiding worth, neutron spectrum U-238 and Pu Doppler effect, material-worth and reaction-rate traverses, and foil activations. In Assembly 48A attention was confined to the worths of B4C rods and their influence on reaction rates and material worths. In Assembly 48B, a limited selection of the Assembly 48 measurements was repeated, including the worths of Na-voiding and the Doppler effects in U-238. Author (NSA)

N71-31778# Argonne National Lab., Ill.

SAS1A: COMPUTER CODE FOR THE ANALYSIS OF FAST REACTOR POWER AND FLOW TRANSIENTS

J. C. Carter, G. J. Fischer, T. J. Heames, D. R. Farlane, N. A. McNeal et al Oct. 1970 309 p refs

(Contract W-31-109-eng-38)

(ANL-7607) Avail: NTIS

The SAS1A computer code is a comprehensive code designed for analyzing both flow and power transients for the large LMFBR cores. The models, numerical methods, and programming details used in its development as well as the input–output, including a sample problem, are described. Since SAS1A is intended to be a complete accident package, the analysis can be carried from a normal operating state of the reactor up to and through thresholds for irreversible fuel and/or cladding damage, finally terminating in core disassembly (if prior calculated events so dictate). SAS1A is the first in a planned series of SAS codes which are currently under development. The code is available in CDC 3600 and IBM 360 (75) versions. Author (NSA)

N71-31819# Oak Ridge National Lab., Tenn.
OAK RIDGE RESEARCH REACTOR Quarterly Report, Oct.–Dec. 1970
S. S. Hurt, III and W. H. Tabor 22 Mar. 1971 37 p
(Contract W-7405-eng-26)
(ORNL-TM-3369) Avail: NTIS

The ORR operated 92.2% of the time during October, November, and December of 1970 at an average power level of 29.9 MW/operating hour. There was a slight increase (approximately 10% as compared with the average for 1969) in the radioactivity of the reactor water caused by a small leak of fission gases from a fuel element. The exact method of escape was not discovered, however, the leak caused no significant problems and the leaky element was isolated. Twenty-one fuel elements were declared spent during the quarter, with an average burnup of 51.3%. Fuel elements spent during the year totaled 104, as compared with only 87 for 1969; however, the average for three years (1968, 1969, 1970) is 93.6 per year which compares quite favorably with the number anticipated (99 per year) when the fuel content per new element was increased to 240 g. The reactor was scheduled down on nine occasions and encountered four unscheduled shutdowns, one of which resulted in an unscheduled refueling. Consequently, unscheduled downtime was high (4.2% of the total) as compared with recent experience but was still rather insignificant. Modifications and maintenance requirements during the quarter are described. Author (NSA)

N71-31820# Babcock and Wilcox Co., Lynchburg, Va. Nuclear Power Generation Dept.
THE 1000 MWe LMFBR ACCIDENT ANALYSIS AND SAFETY SYSTEM DESIGN STUDY. TOPICAL REPORT: EFFECTS OF IRRADIATION-INDUCED METAL SWELLING ON THE REFERENCE DESIGN
B. J. Goulding Nov. 1970 240 p refs Prepared for Argonne Natl. Lab., Ill.
(BAW-1355) Avail: NTIS

The work performed to ascertain the effects of irradiation-induced metal growth on core components subjected to operating characteristics as defined by 1000-MW(e) LMFBR reference design is reviewed. Four metal growth correlations were reviewed and compared. Several possible solutions were evaluated in separate studies, and the results from these studies formed the basis for defining a modified design. This modified design, which utilizes a core clamp device, resulted in a reduction of peak volumetric growth from 35 to 18%. The economic penalty associated with this reduction is less than 0.4 mill/kWh. Author (NSA)

N71-31897# Babcock and Wilcox Co., Lynchburg, Va. Argonne National Lab., Ill.
A 1000-MWe LMFBR ACCIDENT ANALYSIS AND SAFETY SYSTEM DESIGN STUDY. TOPICAL REPORT: CANDIDATE SECONDARY CONTAINMENT SUPPORT SYSTEMS
H. Honig, J. R. Burris, and Q. B. DuBois 30 Aug. 1971 138 p refs Sponsored by AEC Prepared for Argonne Natl. Lab.
(BAW-1349) Avail: NTIS

The work performed to complete the 1000-MW(e) LMFBR Accident Analysis and Safety System Design Study is described. Resultant temperature and pressure effects of spray fires and pool fires were investigated to determine features and systems that might be required to protect the public. A literature survey on reactor containments was conducted to determine the minimum practical leak rate to be expected from the containment building. Environmental calculations were then made using this leak rate as a means of determining the maximum allowable concentration of fission products, sodium-24, and plutonium in the containment building. Suggested features and systems are presented as possible candidates. Author (NSA)

N71-31898# General Electric Co., Sunnyvale, Calif. Breeder Reactor Development Operation.
SODIUM COOLED REACTORS FAST CERAMIC REACTOR DEVELOPMENT PROGRAM Quarterly Report, Nov. 1970–Jan. 1971
Mar. 1971 101 p refs
Contract AT(04-3)-189)
(GEAP-10028-37; QR-37) Avail: NTIS

The Fast Ceramic Reactor Development Program is an integrated analytical and experimental program directed toward the development of fast reactors employing ceramic fuels, with particular attention to mixed plutonium-uranium oxide. Its major objectives are: (1) development of selected portions of a reliable, high performance fast reactors having nuclear characteristics which provide stable and safe operation, and (2) demonstration of low fuel cycle cost potential for such reactors, primarily through achieving high burnup of ceramic fuels operating at high specific power. Author

N71-31938# Westinghouse Electric Corp., Pittsburgh, Pa. Nuclear Energy Systems Div.
PART LENGTH ROD CONTROL SYSTEM
A. E. Blanchard Mar. 1971 23 p
(WCAP-7406) Avail: NTIS

A functional description of the control system used for operating the part length rod drive mechanisms present in Westinghouse pressurized water reactors is presented. The system has been designed to satisfy the requirements for two, three, and four loop plants. Detailed descriptions of the major subassemblies which comprise the system, the operational features of these sub-assemblies and the overall operational capabilities of the entire system are presented. Author (NSA)

N71-31993# Babcock and Wilcox Co., Lynchburg, Va. Nuclear Power Generation Dept.
THE 1000 MWe LMFBR ACCIDENT ANALYSIS AND SAFETY SYSTEM DESIGN STUDY: CANDIDATE EMERGENCY DECAY HEAT REMOVAL SYSTEMS
A. L. Honig and A. L. Mercado Nov. 1970 94 p Prepared for Argonne Natl. Lab., Ill.
(BAW-1351) Avail: NTIS

Candidate systems for emergency decay heat removal were identified and developed to the extent required for an initial screening of questionable systems. These systems were based on anticipated requirements which were arbitrarily imposed pending results from other activities which will establish the functional requirements for the emergency decay heat removal system. The possibility of containing molten fuel was examined along with various ways of cooling it. This investigation covered: (1) meltdown pan features and requirements to determine the possibility of containing molten fuel from a hypothetical seven-fuel assembly meltdown inside the core vessel, (2) a sodium-cooled pan located outside the primary tank to accommodate the entire molten core as a last-ditch cooling system, and (3) characteristics governing the potential for natural circulation of primary sodium under a range of thermal duties. Author (NSA)

N71-32035# Commissariat a l'Energie Atomique, Cadarache (France). Centre d'Etudes Nucleaires.
REACTIVITY MEASUREMENTS USING THE CONTINUOUS RUN TECHNIQUE [MESURES DE REACTIVITE PAR LA TECHNIQUE DE L'ANALYSE DU FLUX (CONTINUOUS RUN)]
Hans G. Eckert and Rene Jacquemart Feb. 1971 39 p refs In FRENCH
(CEA-N-1385) Avail: AEC Depository Libraries

The reactivity of a reactor can be determined by the continuous run technique, a signal being continuously measured which is proportional to the power. The method is particularly suitable for the calibration of absorbers in reactor physics, such as control elements or safety rods. The theoretical aspects of the method and the knowledge acquired from tests made on the mock-up of the high flux Franco–German reactor are presented. The results are compared with those obtained using other methods, such as divergences and pulsed neutron techniques. Author (NSA)

N71-32041# Stockholm Univ. (Sweden).
SOME STUDIES ON THE BURN UP OF NUCLEAR FUEL
R. S. Forsyth (Ph.D. Thesis) Apr. 1970 31 p refs
(INIS-mf-29) Avail: AEC Depository Libraries

A short review of the problems involved, and the techniques used, in determining the burnup of nuclear fuel is given. Contributions on destructive and nondestructive analysis are described. The principles of the use of stable fission product nuclides are presented and illustrated by the use of the molybdenum stable fission product isotopes. The applications of both NaI detectors and Ge(Li) detectors for the gamma spectrometric examination of irradiated fuel are described. NSA

N71-32062# Babcock and Wilcox Co., Lynchburg, Va. Nuclear Power Generation Dept.
THE 1000-MWe LMFBR ACCIDENT ANALYSIS AND SAFETY SYSTEM DESIGN STUDY. ACCIDENT INITIATING CONDITIONS. PART 2: REACTIVITY INSERTIONS
J. H. Scott Oct. 1970 37 p refs Sponsored by AEC Prepared for Argonne Natl. Lab., Ill.
(BAW-1360 Pt-2) Avail: NTIS

The consequences of reactivity insertions arising from definable malfunctions or events have been investigated. The specific events that were identified, without regard to credibility, are as follows: single rod withdrawn at 30 in./s; continuous withdrawal of four regulating rods at shim speed; gas bubble(s) entrained in the coolant; loading accidents; moderator entrainment; sudden fuel movement; and drop in inlet temperature. In addition to the mechanistic study outlined above, a series of calculations was performed to determine the dynamic response of the reactor to arbitrary ramp reactivity insertions. This permitted the defining of parameters related to the protection system design, and the determining of intrinsic stability of the reactor. The results of these investigations are summarized. Author (NSA)

N71-32063# Babcock and Wilcox Co., Lynchburg, Va. Nuclear Power Generation Dept.
THE 1000 MWe LMFBR ACCIDENT ANALYSIS AND SAFETY SYSTEM DESIGN STUDY: CANDIDATE PROTECTIVE FEATURES
R. C. Wilson Nov. 1970 68 p refs Sponsored by AEC Prepared for Argonne Natl. Lab., Ill.
(BAW-1354) Avail: NTIS

The work performed to complete Activity 241 (review and identify candidate protective features) of the 1000-MW(e) LMFBR accident analysis and safety system design study is described. A literature survey was conducted to determine the approach to protection taken in other LMFBR designs, and to identify protective features (especially instruments) that may be available. An updated estimate of possible protective requirements was prepared to help guide the effort. An initial assessment resulted in identification of several possible candidate features. The major unresolved problem area is in determining and providing the protection needed for local accidents that may initiate within a fuel assembly. Author (NSA)

N71-32064# Babcock and Wilcox Co., Lynchburg, Va. Nuclear Power Generation Dept.
THE 1000-MWe LMFBR ACCIDENT ANALYSIS AND SAFETY SYSTEM DESIGN STUDY: CANDIDATE PRIMARY CONTAINMENT SAFETY FEATURES
J. S. Dossett and F. X. Masseth Nov. 1970 90 p refs Sponsored by AEC Prepared for Argonne Natl. Lab., Ill.
(BAW-1352) Avail: NTIS

The work performed to complete Activity 243 (identify and review candidate primary containment safety features) of the 1000-MW(e)LMFBR accident analysis and safety system design study is described. A literature survey was conducted to determine the potential accident conditions in the primary containment and to find potential candidate solutions to the problems. Underwater TNT-equivalent explosions were assumed, and the resultant loading conditions were calculated. Suggested features are presented as possible methods of solution. Author (NSA)

N71-32066# Bhabha Atomic Research Centre, Bombay (India). Metallurgy Div.
IRRADIATION EFFECTS ON REACTOR STRUCTURAL MATERIALS
K. S. Sivaramakrishan, B. D. Sharma, and P. Rodriguez 1970 15 p refs Presented at Symp. on Mater. Sci. Res., Bangalore, India, 24 Feb. 1970
(INIS-mf-5) Avail: AEC Depository Libraries

Irradiation induced hardening in reactor structural materials is reviewed from both engineering as well as fundamental points of views. Dose damage characteristics, irradiation effects on impact properties, and recovery behavior of radiation damage in zirconium-base alloys and steels both austenitic and ferritic are included. The current concepts of radiation hardening mechanism are discussed briefly. NSA

N71-32067# Japan Atomic Energy Research Inst., Tokyo.
ANALYSIS OF INSTRUMENTATION DATA FROM IFA-150 IRRADIATED IN HBWR
Michio Ichikawa, Atsuyoshi Morishima, and Kiyoaki Taketani Dec. 1970 26 p refs In JAPANESE
(JAERI-Memo-4248) Avail: AEC Depository Libraries

Irradiation of IFA-150 (Instrumented Fuel Assembly) was started in May 1968 in HBWR and ended in March 1970 with burnup of 11,400 MWD/T. IFA-150 was irradiated with IFA-149, which is of the same design and contains the same fuel as that in IFA-150. The data obtained from these assemblies are quite similar. IFA-150 was aimed to prove the integrity of the fuel rods for JPDR-II project. The fuel rods with diameter of 12.23 mm were arranged in 3 × 3 square lattice. Fuel rods were provided with 2 fission gas transducers, 3 oxide center thermocouples and 8 fuel rod elongation monitors. The data from the instrumentation are analyzed. The maximum linear heat rating of the fuel rods was calculated to be 420 W/cm. NSA

N71-32068# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
MEASUREMENT OF THE KINETIC PARAMETERS OF THE MINERVE REACTOR FROM ANALYSIS OF THE NEUTRON FLUCTUATIONS [MESURE DES PARAMETRES CINETIQUES DU REACTEUR MINERVE PAR L'ANALYSE DES FLUCTUATIONS NEUTRONIQUES]
Jeane-Claude Carre, Jaime M. Costa Oliveira, and Francoise Roullier Feb. 1971 56 p refs In FRENCH
(CEA-N-1406) Avail: AEC Depository Libraries

The kinetic parameters of a reactor can be determined by analyzing the degree of correlation in the information obtained from one or two detectors of adequate efficiency. The parameters which can be measured include the transfer function at the measurement point, the neutron generation time, and the reactor power. The method was applied to the Ermine reactor, which is a thermal reactor, coupled at its center to part of a fast lattice. Intercorrelation measurements yielded a generation time of 107 + or − 6 microseconds. This value is compared with values obtained with the same lattice using the alpha Rossi method and the modulation method. Autocorrelation measurements with a single chamber gave a value of 33 + or − 4 W for the operating power, which is in agreement with the previously estimated value.
Author (NSA)

N71-32070# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
MEASUREMENT OF THE TRANSFER FUNCTION OF A REACTOR BY REACTIVITY MODULATION
Jean-Claude Carre and Jaime M. Costa Oliveira Feb. 1971 82 p In FRENCH
(CEA-N-1405) Avail: AEC Depository Libraries

In order to experimentally investigate transfer functions a reactivity modulator covering a large frequency range (0.01 to 100 Hz) and digital recording equipment for measuring the variations in the number of neutrons collected by a detector were developed. Measurements of transfer functions in the critical state were made for three thermal reactor configurations: Minerve with part of the lattice center modulated with heavy water, Ermine and Ulysse with various detector positions. The measurements made indicate the importance of space effects in reactor dynamics at high frequencies. The neutron generation time for Ermine was found to be 106 + or − 5 microseconds.
Author (NSA)

N71-32071# Kernforschungszentrum, Karlsruhe (West Germany). Labor fuer Elektronik und Messtechnik.
CLADDING MONITORING IN SODIUM COOLED REACTORS BY DETECTION OF DELAYED NEUTRONS [HUELLENUEBERWACHUNG AN NATRIUMGEKWEHLTEN REAKTOREN DURCH NACHWEIS VERZOEGERTER NEUTRONEN]
S. Jacobi and G. Schmitz Feb. 1971 21 p refs In GERMAN; ENGLISH summary
(NP-18778) Avail: AEC Depository Libraries

The detection of fuel pin failures in sodium cooled reactors by monitoring of delayed neutrons is examined. Experimental measurements in the KNK reactor which have led to the design of an improved system for the SNR are described. Calculations are presented to show that the smallest detectable free fuel pin surface is between 0.2 and 2 sq cm. Diagrams indicate the effects of transit time from core to monitor on the neutron activity concentration.
Author (NSA)

N71-32109# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Reaktorentwicklung.
INFLUENCE OF REAL DEAD-TIME SIMULATION ON THE DYNAMIC BEHAVIOR OF THE COMPUTER MODEL OF THE AUTOMATICALLY CONTROLLED Na-2 REACTOR
C. Koepp Jul. 1970 85 p refs Transl. into ENGLISH from German report KFK-1179 Sponsored in part by USAEC/Euratom Fast Reactor Exchange Program
(EURFNR-835; EUR-3708d) Avail: NTIS

The results of the Na-2 reactor control studies which were carried out with the digital dynamic simulator DAS2 on the IBM 360/65 computer are presented. A certain number of studies were done on the IBM 360/91 computer; for these it was necessary to make some changes in the control cards. The aim was to discover whether the generally applied simulation of the dead-time relations in the model by first-order time delays yields a better automatic control behavior than does simulation by real dead-time members.
Author (NSA)

N71-32109# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.
HOW TO USE THE CODE, COMET [MODE D'EMPLOI DU CODE COMET]
M. Lecloux 1971 74 p ref In FRENCH
(EUR-4562f) Avail: AEC Depository Libraries

The mathematical formulae for calculating mechanical and thermal stresses in the cladding of a fuel element are given. The structure of the calculation code and the necessary information for the correct use of the code are included.
Author (NSA)

N71-32120# Idaho Nuclear Corp., Idaho Falls.
THETA1-B: A COMPUTER CODE FOR NUCLEAR REACTOR CORE THERMAL ANALYSIS
C. J. Hocevar and T. W. Wineinger Feb. 1971 112 p refs
(Contract AT(10-1)-1230)
(IN-1445) Avail: NTIS

A digital computer code, THETA1-B, was developed to study the thermal response characteristics of a nuclear fuel rod subjected to a postulated loss-of-coolant accident environment. The energy equations for both the fuel rod and the adjacent fluid channel are solved. A heat transfer model is employed to link the solutions of the two energy equations. This model has been developed on the basis of heat transfer correlations available in the open literature. The code has the capability of modeling electrically heated test elements. This feature allows the postulated heat transfer model to be evaluated in terms of experimental heat transfer data obtained during decompression tests.
Author (NSA)

N71-32127# Arizona Univ., Tucson. Dept. on Nuclear Engineering.
STABILITY DOMAINS IN NONLINEAR POINT REACTOR DYNAMICS
James Michael Kendall (Ph.D. Thesis) Jan. 1971 47 p refs
(Contract AT(04-3)-670)
(COO-2109-3) Avail: NTIS

The nonlinear point reactor kinetics model with linear reactivity feedback is studied to determine stable regions of the state space. Geometric and Liapunov techniques are used to determine system stability and effects of system parameters on the stable region. In studying the one temperature region model with effective lifetime kinetics and a power coefficient, a transformation is obtained which simplifies analysis of the system. Using this transformation an exact solution is found for parameter values such that the system is a nonlinear center. In addition, a Liapunov function is developed which proves asymptotic stability for an infinite sector of the phase space. The stable region shown by this method is compared to those shown by previous techniques for a given set of parameters.
Author (NSA)

N71-32140# FIAT S.p.A., Turin (Italy).
EXPERIMENTAL DETERMINATION OF THE TURBULENT DIFFUSIVITY COEFFICIENT IN A BUNDLE OF RODS WITH AND WITHOUT SPACER GRIDS [DETERMINAZIONE SPERIMENTALE DEL COEFFICIENTE DI DIFFASIVITA TURBOLENTA IN UN FASCIO DI BARRE CON E SENZA GRIGLIE DISTANZIATRICI]
M. Debernardi and A. Veltancoli 1971 26 p refs In ITALIAN
Prepared in cooperation with Ansaldo S.p.A.
(Contract EURATOM-008-61-12 PNII)
(EUR-4552) Avail: AEC Depository Libraries; EUR Lit. 500.

The turbulent diffusivity coefficient of the coolant was

determined experimentally by means of the tracer method, by injecting water of a temperature exceeding that of the water circulating in the section being tested. The geometry within which the water flows was formed by a bundle of rods arranged in the form of a square lattice; the pitch/diameter ratio was 1.31. The determinations were made both without spacer grids and with spacer grids of the ferrule type. The determinations were successively made with an inclined grid device adapted to increase the transfer of mass through the channels of the bundle. A comparison of the results with those of other experiments shows that the coefficient of turbulent diffusivity increases with an increasing pitch/diameter ratio. The sequence of the tests shows the influence on the turbulent mixing of spacer grids with a special geometrical arrangement. Author (NSA)

N71-32141# FIAT S.p.A. Turin (Italy).
TIGER: PROGRAMME FOR THE CALCULATION OF THE THERMAL CROSS SECTIONS IN A LIGHT-WATER NUCLEAR REACTOR [TIGER: PROGRAMMA PER IL CALCOLO DELLE SEZIONI D'URTO TERMICHE IN UN REATTORE NUCLEARE AD ACQUA LEGGERA]
L. Criscuolo and V. Paterlini Mar. 1971 88 p refs In ITALIAN
Prepared in cooperation with Ansaldo S.p.A.
(EUR-4554) Avail: AEC Depository Libraries; EUR Lit. 1.560

The TIGER program which calculates the thermal spectrum in a fuel cell with particular reference to the zones to which the latter is subdivided (fuel, cladding and moderator) is discussed. The heterogeneity of the cell is taken into consideration by defining in each of the 310 thermal microgroups of a scheme similar to the SOFOCATE, average thermal cross sections weighted on the local cell fluxes, calculated by means of the Amouyal and Benoist model. With such a homogenisation, depending on the energy, it is possible to use a thermalisation model based on a homogeneous medium. The model used in the TIGER is SOFOCATE. It is possible to obtain thermal constants averaged over one of the following spectra: Maxwellian; Wigner and Wilkins (light moderator); and Wilkins (heavy moderator) with a cut-off higher than the energy interval variable up to 2 eV. Author (NSA)

N71-32147# General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.
DEFICIENT COOLING Quarterly Progress Report, 1 Oct.–31 Dec. 1970
Dec. 1970 18 p
(Contract AT(04-3)-189)
(GEAP-10221-6; QPR-6) Avail: NTIS

A nine-rod subchannel sampling with typical grid spacers, 4 inches upstream of the sampling section, was accomplished for the first time with the simultaneous sampling of three unique subchannels in the 3 × 3 array. Data were taken with 80 to 100 F water at 100 and 1000 psig, several exit qualities, and mass velocities of 0.5, 1.0, 1.5, and 2 × 10 to the 6th power lb/h-sq ft. The single phase runs showed a good mass balance between the total measured flow and that calculated from subchannel measurements were reliable. The corner and side subchannel measurements are under some question due to a possibility of leakage past the sampling tube gaskets. The general effect of the grid spacer, when data is compared to that in a clean channel with button spacers instead of grids, is to decrease flow in the center channels and increase it in the side and (apparently) the corner channels. The two phase data showed a mass defect of over 10% which was attributed to loss of sampling seals discovered at disassembly. This data will be rerun with redesigned sampling tubes which should avoid leakage. Author (NSA)

N71-32154# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Material- und Festkoerperforschung.
VARIATION IN THE THERMAL CONDUCTIVITY OF AN OXIDE FUEL ELEMENT DURING BURNUP
H. Kleykamp Jul. 1970 19 p refs Transl. into ENGLISH of German report KFK-1245 Sponsored by US-EURATOM Fast Reactor Exchange Program
(EURFNR-817; KFK-1245) Avail: NTIS

The change in thermal conductivity of mixed-oxide fuel during burnup is discussed. The influence of the porosity and change in stoichiometry, as well as the heat-transfer coefficient, is estimated. The formation of the fission products during burnup led to a decrease in thermal conductivity. The latter fell by 25% after a burnup of 10% due to the solid solution formation (U,Pu)-oxide-rare earth oxides-ZrO2. An increase of about 8% compared with the pure matrix is to be expected in the case of metallic and oxide/inclusions in dispersion form. Author (NSA)

N71-32157# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
CONTAINMENT DESIGN CRITERIA FOR SODIUM COOLED FAST REACTORS [CRITERI DI PROGETTO PER IL CONTENIMENTO DI REATTORI VELOCI DI POTENZA A SODIO]
L. Bruzzi, G. Cicognani, R. Tavoni, and N. Travaglini 12 Nov. 1970 28 p refs In ITALIAN
(RT/ING-(70)25) Avail: AEC Depository Libraries

The differences between the containment philosphy for sodium cooled fast reactors and for other types of reactors in connection with the selected Design Basis Accident are discussed. The general containment design criteria for fast reactors are analyzed; in particular the design criteria adopted for the reference fast power reactor PCC are identified and defined. Author (NSA)

N71-32174 National Lending Library for Science and Technology, Boston Spa (England).
PITTING AND CONTACT CORROSION IN MAGNESIUM-CANNED FUEL RODS
M. Thomas et al 10 Sep. 1970 14 p Transl. into ENGLISH from Werkstoffe Korrosion (West Germany), v. 19, no. 10, 1968 p 895–900
(NLL-CE-Trans-5440-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

When nuclear fuel elements - containing Mg, graphite and Zircaloy - are stored in water there is the danger of contact corrosion of Mg in contact with graphite; in particular when chlorides are present (even in traces) there exists the danger of pitting corrosion. Only at pH values larger than 11.5 a hydroxide layer is formed which yields a certain protection. The pitting potential in alkaline waters is shifted to more negative values with increasing chloride content; this displacement can be prevented by inhibitors. The addition of sodium carbonate which gives rise to the formation of a protective hydromagnesite layer is more effective. Author

N71-32248# Babcock and Wilcox Co., Lynchburg, Va. Nuclear Power Generation Dept.
THE 1000 MWe LMFBR ACCIDENT ANALYSIS AND SAFETY SYSTEM DESIGN STUDY. TOPICAL REPORT: ACCIDENT-INITIATING CONDITIONS. PART 1: FLOW ABNORMALITIES
J. H. Scot and R. W. Moore Nov. 1970 110 p refs Prepared for Argonne Natl. Lab., Ill.
(BAW-1350-Pt-1) Avail: NTIS

The following abnormalities of the primary loop investigated: complete loss of six primary pumps, complete loss of two primary pumps, and double-ended break in a 28-inch primary pipe. Instantaneous loss of the heat sink was the only event investigated under secondary loop abnormalities. Appropriate sensivity studies were performed. The results indicate that no fuel melting or cladding failure occurs for any transient so long as the protective system functions normally. As to flow abnormalities in the primary loop, three levels of protection may be by passed before failure thresholds are approached. If one postulates such partial failure of

the protection system and a rapid flow decay, then high cladding temperatures occur in the hot pin. These temperatures are probably sufficient to cause some cladding failure. It is concluded that no irreversible damage results from identifiable flow abnormalities unless partial failure of the protection system is postulated. At least three levels of protection must fail before even limited cladding failure can occur. Thus, the probability that flow abnormalities at full power will lead to gross core damage is extremely small.
Author (NSA)

N71-32273*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
BERYLLIUM BEHAVIOR IN THE NASA PLUM BROOK REACTOR
R. A. Hasse [1971] 35 p refs Presented at the 5th Conf. of the Reactor Operations Div. of the Am. Nucl. Soc., Denver, 9–11 Aug. 1971
(NASA-TM-X-67894) Avail: NTIS CSCL 18I

Two beryllium structural plates in the Plum Brook Reactor bowed toward the fuel core, and eventually failed by gross cracking. This behavior was evaluated in terms of mechanical and physical property changes of the irradiated material, internal and external stresses experienced by the plates, plate fabrication techniques, and reactor operating history. The preliminary evaluation did not permit firm conclusions to be drawn. However, the amount of bow per unit dose was proportional to the mean reactor power level. The internal stresses alone may have approached the measured tensile strength of the beryllium.
Author

N71-32284# Gulf General Atomic, San Diego, Calif.
HTGR BASE PROGRAM Quarterly Progress Report, Period Ending 30 Nov. 1970
31 Dec. 1970 99 p
(Contract AT(04-3)-167)
(GA-10399) Avail: NTIS

The preliminary design and development of a 1000 MW(e), gas-cooled, nuclear power reactor concept incorporating advanced technology is described. The exploratory development effort includes: high conversion rates of fuel in a high temperature, gas-cooled thermal reactor using a thorium uranium 233 fuel cycle; advanced reactor fuel elements, which may include simpler configurations and different methods of processing and fabricating, to extend fuel lifetime and reduce fuel costs; and alternative plant arrangements to reduce plant capital costs, including such possibilities as alternative materials and the assembly of the reactor and steam generating equipment in a single containment.
J.G.M.

N71-32296# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
DESIGN AND DEVELOPMENT OF PACKAGINGS FOR LOW ENRICHED FUEL BUNDLES [CONCEPTION ET DEVELOPPEMENT D'EMBALLAGES POUR LES GRAPPES DE COMBUSTIBLE FAIBLEMENT ENRICHI]
W. R. Taylor Jan. 1971 9 p Presented at Seminar on Test Requirements for Packaging for the Transport of Radioact. Mater., Vienna, 8 Feb. 1971
(AECL-3803; Conf-710210-2; SM-147/4) Avail: AEC Depository Libraries; AEDC$0.50

A package was designed to transport single unirradiated Candu-type fuel bundles between fuel manufacturers and reactor sites. The package consists of an extended 45 Imperial gallon drum, an 8-inch pipe and vermiculite insulation. A single fuel bundle is packed in a styrofoam mold and fitted into the 8 inch pipe. A shipment consists of forty packages, each with a 2.4 weight percent U-235 in U fuel bundle. A prototype packaging was loaded with a simulated fuel bundle and subjected to Type B destructive tests. A second packaging was subjected to Type A tests. The packaging did not rupture, the fuel bundle was not damaged, and package separation distances were maintained. An analysis showed that the packages would be nuclearly safe for normal and hypothetical accident conditions of transport. A second generation packaging is being designed. This packaging consists of a 45 Imperial gallon drum, rigid polyurethane foam insulation and a four fuel bundle compartment. The results of the test program and the proposed new packaging are described.
Author (NSA)

N71-32302# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Angewandte Reaktorphysik.
MEASUREMENT OF NEUTRON SPECTRA WITHIN THE 1 eV TO 10 keV ENERGY RANGE BY MEANS OF THE SANDWICH TECHNIQUE
M. Mueller Jul. 1970 112 p refs Transl. into ENGLISH from German report KFK-1233 Sponsored in part by USAEC/Euratom Fast Reactor Exchange Program
(EURFNR-842; KFK-1233) Avail: NTIS

Twenty-one different resonance absorbers were investigated theoretically and experimentally in order to check their suitability as sandwich detectors for the determination of neutron spectra in fast reactors below the energy of 10 keV. The obtainable accuracy of the measured results of all detectors was found to be influenced strongly by the hardness of the neutron spectrum. By means of the absolute cross sections of gold and manganese the results could be given absolutely. The accuracy of the measurements was 10–20% for spectra similar to those in a fast steam-cooled breeder reactor and 20–40% for spectra similar to those in a fast sodium-cooled breeder reactor.
Author (NSA)

N71-32304# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Material- und Festkoerperforschung.
STOICHIOMETRY SHIFT IN AN OXIDE FUEL ELEMENT AT HIGH BURNUP
H. Holleck et al Aug. 1970 68 p refs Transl. into ENGLISH from German report KFK-1181 Sponsored in part by USAEC/EURATOM
(EURFNR-836) Avail: NTIS

The contributing factors leading to a change in stoichiometry of an oxide-fuel during burnup are discussed. The arising fission products alter the average final stoichiometry, while gas equilibria above the oxide determines the stoichiometry at a particular point. The thermodynamics of the mixed oxide and of the fission product oxides were studied. Experimental results concerning irradiated samples are discussed and related to equilibrium states in fuels with high burnup.
Author (NSA)

N71-32309# Comitato Nazionale per l'Energia Nucleare, Casaccia (Italy). Centro di Studi Nucleari.
NUCLEAR FUEL CHARACTERIZATION
A. Allegro, E. Ferrante, M. Francia, G. Modugno, and L. Stampa 2 Oct. 1970 15 p Presented at Italian-Polish Meeting, Warsaw, 26 May–6 Jun. 1970
(RT/ING-(70)21; Conf-700556-1) Avail: AEC Depository Libraries

A careful investigation of the parameters influencing solid state densification phenomena is essential for obtaining ceramic fuel material, with pre-established form and dimensions, from ceramic grade powders. The problem was studied by developing investigation methods and characterizing starting powders, where surfaces and porosities provide the forces which cause sintering phenomena; products deriving from the various operations of the fabrication processes; and finished materials. Moreover, a careful study of the microstructural variations of nuclear fuel, undergoing conditions simulating those typical of in-pile fuel operation is very important for an evaluation of the behavior of fuel under irradiation. Simulation studies and experiments carried out with different heating systems are described.
Author (NSA)

N71-32309# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Reaktorentwicklung.

OPTIMIZATION OF SODIUM-COOLED FAST BREEDERS BY NONLINEAR PROGRAMMING METHODS

G. Heusener Jul. 1970 104 p refs Transl. into ENGLISH from the German report

(EURFNR-830; KFK-1238) Avail: AEC Depository Libraries

Two methods of nonlinear programming to optimize fast breeder reactors are described. One uses the method of steepest descent and the other is a statistical procedure involving evolution strategy. As example for the application of these methods, a core optimization for sodium cooled 1000 MW(e) breeder reactors with oxide and carbide fuel is considered. To reduce computer time, approximations in nuclear computations are necessary. A procedure is described that allows a fast and sufficiently accurate estimation of the nuclear results. The optimization is performed with regard to two different criteria, and the resulting design characteristics are discussed. Using importance quantities, which are obtained as part of the solution, the influence of the design limits upon the optimization criterion is predicted quantitatively. By recalculating some special cases the reliability of the predictions is demonstrated. Author (NSA)

N71-32565# WADCO Corp., Richland, Wash. Hanford Engineering Development Lab.

EUROPEAN LIQUID METAL COOLED BREEDER REACTOR INSTRUMENTATION: A TRIP SUMMARY

Carl D. Swanson Mar. 1971 22 p Presented at Instr. Soc. of Am. Meeting, Richland, Wash., 13 Apr. 1971

(Contract AT(45-1)-1270)

(HEDL-SA-170; Conf-710412-1) Avail: NTIS

Impressions of a tour of European reactor installations and support facilities made in October 1969 are presented. Visits were made to fast breeder reactor installations at Cadarache in France, Karlsruhe in Germany, and at four sites in the United Kingdom. The basic emphasis of the visits was to discuss sodium-cooled fast reactor instrumentation and control technology development at the various installations. NSA

N71-32569# Babcock and Wilcox Co., Lynchburg, Va. Power Generation Div.

THE 1000 MWe LMFBR ACCIDENT ANALYSIS AND SAFETY SYSTEM DESIGN STUDY. ACCIDENT ANALYSIS METHODS Topical Report

J. H. Scott, M. G. Stevenson, and R. W. Moore Nov. 1970 117 p refs Sponsored by AEC Prepared for ANL

(BAW-1342) Avail: NTIS

The methods and models that will be used in the accident analysis and safety system design study are described. In most cases the rationale for methods selection is given; in other cases, only a single model seemed adequate for a particular application, and this is stated. Insofar as possible, the way that selected methods will be applied to the analysis is indicated. In addition, significant problem areas in fast reactor safety are discussed along with their importance to accident analyses. In some cases, prospective solutions are discussed. The appendix provides detailed descriptions of the computer programs that will be used in the accident analysis but are not widely known in the nuclear industry. Author (NSA)

N71-32576# FIAT S.p.A., Turin (Italy). Sezione Energia Nucleare.

STAZ-2: PROGRAMME FOR THE THERMOHYDRAULIC ANALYSIS OF A CHANNEL OF A WATER-MODERATED AND COOLED NUCLEAR REACTOR CORE OPERATING IN THE STATIONARY STATE

A. Besi, V. Magri, G. Previti, and G. F. Antognetti Mar. 1971 72 p refs

(EUR-4553) Avail: AEC Depository Libraries

The STAZ-2 code, programmed for the IBM 704 computer, is intended for the thermohydraulic analysis of a water-moderated and cooled nuclear reactor channel operating in the stationary state. The code takes into consideration cores with a single passage and closed channels with fuel elements of the bundle type or slab type, and calculates the distribution of the coolant and fuel, the distribution of the density and the voids, the load losses, and the DNB ratio (the ratio of the critical thermal flux and the actual thermal flux). Author (NSA)

N71-32577# WADCO Corp., Richland, Wash.

IRRADIATION EFFECTS ON REACTOR STRUCTURAL MATERIALS Quarterly Progress Report, Aug. – Oct. 1970

T. T. Claudson, ed. Jan. 1971 379 p

(Contract AT(45-1)-2170)

(WHAN-FR-40-1) Avail: NTIS HC$6.00/MF$0.95

Progress on materials research conducted at Argonne National Laboratory, Battelle Memorial Institute, Idaho Nuclear Corporation, Naval Research Laboratory, and Hanford Engineering Laboratory is summarized. Program coordination activities involving these organizations are also reported. NSA

N71-32580# Westinghouse Electric Corp., Pittsburgh, Pa. Nuclear Energy Systems Div.

ROD POSITION MONITORING

A. E. Blanchard Mar. 1971 17 p refs

(WCAP-7571) Avail: NTIS

Rod position monitoring in pressurized water reactors is performed by two independent indication systems. The demand position indication is generated within the part length and full length rod control systems and furnishes an indication of the position that a group of rods should assume in response to command signals generated within each control system. The actual position indication is generated within the analog rod position indication system and furnishes individual indication of the actual position each rod has assumed in response to the control system command signals. Both actual and demand position information is displayed on the control board and both are monitored by the plant computer as part of the rod deviation monitoring program. A detailed functional description of the analog rod position indication system is presented and a general description of the demand position indication system is also included. Author (NSA)

N71-32581# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Nuclear Labs.

THERMAL TEST CALCULATIONS FOR PACKAGES OF STEEL CONSTRUCTION

W. R. Taylor Jan. 1971 10 p Presented at Seminar on Test Requirements for Packaging for the Transport of Radioactive Mater., Vienna, 8 – 12 Feb. 1971

(AECL-3802; IAEA-SM-147/5; Conf-710210-1) Avail: AEC Depository Libraries; Atomic Energy of Can., Ltd., Chalk River: $0.50

Two Canadian packagings were fabricated from steel for irradiated fuel shipments. A computer program was developed to calculate package temperatures during and after Type B thermal tests. From these results, suitable packaging closures were designed and the maximum fuel sheath temperatures were estimated. One packaging is a solid casting with external cooling fins; the other has a wall cross section which consists of seven 2 inch and two 3/4 inch steel plates. A finite element calculation method is used. A digital computer calculates the transient temperatures for a three dimensional mathematical model. Equations which define heat transfer between the environment and the finite elements calculate element temperatures for each 0.005 hour time increment. Specific heat and thermal conductivity are defined as functions of temperatures. Different cooling modes may be defined and introduced in the calculations. The calculation method and the effects of different variables on the package temperatures are briefly described. Author (NSA)

N71-32590# Institut Atomnoi Energii, Moscow (USSR).
NUCLEAR DATA FOR THERMONUCLEAR REACTORS
Yu. F. Chernilin and G. B. Yan'kov 1970 36 p refs In RUSSIAN
(IAE-1986) Avail: AEC Depository Libraries

The design of a thermonuclear reactor is described and the pertinent nuclear data are analyzed. A brief review is made of published data on Li-6, Li-7, and Nb as effective materials for nuclear reactor operation. An attempt is made to show that the data on nuclear interactions in the power region, determined by thermonuclear neutrons, are insufficient and that further neutronic calculations for blanket assemblies of fusion power reactors are imperative. NSA

N71-32592# United Kingdom Atomic Energy Authority, Springfields (England). Reactor Group.
THEORETICAL WAVING BEHAVIOUR OF MAGNOX FUEL ELEMENT FINS DUE TO COOLANT-GAS INDUCED CORROSION AND TO THERMAL CYCLING
R. G. Anderson 23 Apr. 1970 49 p refs
(TRG-2121) Avail: AEC Depository Libraries; HMSO 7s; BIS $1.40

A comprehensive theory of struts which undergo spontaneous expansion and thermal cycling under conditions of axial restraint, stress relaxation and creep is developed. An approximate extension to finite plates is made. A preliminary check of the approximate plate theory against a numerical method shows good agreement. The theory is applied to explain many features of the in-pile and out-of-pile waving of Dungeness A fins. The effect of thermal cycling is found to have a rather higher relative weighting than that found in earlier work. Thermal cycling could be playing a substantial part in producing Category 10 deformations on Dungeness A fins though a much less important role in higher Category development. The strut theory and the plate approximation are new theoretical contributions to the behaviour of creeping structure and may have applications in other fields both inside and outside fuel element analysis. Author (NSA)

N71-32674# Interuniversitair Reactor Instituut, Delft (Netherlands).
REACTOR RESEARCH Progress Report, 1969–1970
1971 62 p refs In DUTCH
(NP-18711) Avail: AEC Depository Libraries

The studies made in physics, reactor physics, chemistry, and radiation hygiene and radiation dosimetry are summarized. The results of significant experimental and theoretical work were published in the literature, and these citations are tabulated. Future studies are indicated. NSA

N71-32739# Southwest Research Inst., San Antonio, Tex. Dept. of Materials Engineering.
IN-SERVICE INSPECTION PROGRAM FOR NUCLEAR REACTOR VESSELS Biannual Progress Report, 1 Mar.–1 Sep. 1970
Robert D. Wylie 7 Jan. 1971 126 p refs Prepared in cooperation with Edison Electric Inst. and Tennessee Valley Authority, Knoxville
(PB-198274; SA-4) Avail: NTIS CSCL 18I

Experiences with power reactor coolant pressure boundary inspection are reviewed regarding service condition, defect detection capability, defect size, and defect orientation. The design of a nondestructive test method evaluation facility is reported. Investigations of the acoustic spectrometer as a semi- of fully-continuous scanning method are summarized along with acoustic emission techniques for continuous monitoring including evaluation of the acoustic emission system and emission characteristics of irradiated reactor pressure vessel steels. The investigation of data handling techniques as applied to ultrasonic inservice inspection of nuclear reactors is reviewed including ultrasonic technique selection, relationships between reflected ultrasonic signals from machined versus natural defects, influences of stainless steel cladding, and sensitivity stability of standards as a function of temperature, stress, and radiation exposure. Acoustic holography for visualization of flaws in thick-walled pressure vessels is cited as well as information collection, reporting, and dissemination. J.M.

N71-32772# Kernforschungszentrum, Karlsruhe (West Germany).
FAST BREEDER PROJECT Quarterly Report, 1970
Jul. 1970 184 p refs Transl. into ENGLISH from German report KFK-1270/1 Sponsored by US-Euratom
(EURFNR-824; QR-1) Avail: NTIS

Work in the following areas was reported: cladding materials, fabrication, and irradiation testing programs for reactor fuel elements; the development, fabrication, and irradiation testing program for fast breeder reactor fuels; physics parameters, safety, cooling systems, thermodynamic and hydrodynamic core design, and instrumentation and signal processing in core monitoring systems for fast reactors; design parameters of the FR-3; and corrosive effects of liquid sodium on fast breeder reactor materials. J.G.M.

N71-32773# Atomics International, Canoga Park, Calif.
LMFBR SAFETY PROGRAMS Quarterly Technical Progress Report, Oct.–Dec. 1970
22 Feb. 1971 41 p refs
(Contract AT(04-3)-701)
(AI-AEC-12986) Avail: NTIS

Work in the following areas was reported: explosion in liquid sodium of UO2 fuel elements; mechanical energy conversion efficiency and particle size distribution from fuel elements; kinetics and effects of sodium coolant boiling on LMFBR; coolant combustion accidents in LMFBR; and release and transport of aerosols and energy from sodium in LMFBR. J.G.M.

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N71-31720# Stanford Research Inst., Menlo Park, Calif.
MATERIALS PROCESSING OF RARE EARTH COBALT (RECo5) PERMANENT MAGNETS Semiannual Interim Technical Report No. 1, 1 Jul.–31 Dec. 1970
Paul J. Jorgensen Wright-Patterson AFB, Ohio AFML 31 Dec. 1970 39 p refs
(Contract F33615-70-C-1624)
(AD-723295; AFML-TR-71-30) Avail: NTIS CSCL 13/8

Rare earth-cobalt intermetallic compounds show promise for permanent magnets with a higher energy product, BH(max), than are currently available. Because fine particles are required for magnetic alignment and sintering, and since the coercivities of these fine particles are sensitive to overgrinding and particle surface preparation, plasma spheroidization and electrodeposition are being investigated as alternative methods for producing strain-free particles. Apparatus for arc jet plasma spheroidization of particles in argon free of oxygen was constructed and solid spherical particles of SmCo5 and MMCo5 in a size range below 10 micro m were produced. Preferential vaporization of samarium causes a reduction in the samarium content of the spherical particles compared with the feed material and causes the formation of a samarium rich fume. Preliminary fused salt experiments were initiated with the goal of developing methods for electrodeposition of rare earth-cobalt particles. Author (GRA)

N71-31995# California Univ., Berkeley. Lawrence Radiation Lab.
PRINTED-CIRCUIT STEERING COILS
Robert T. Avery, Glen R. Lambertson, and Chester D. Pike Feb. 1971 2 p refs Presented at the Natl. Partical Accelerator Conf., Chicago, 1 Mar. 1971
(Contract W-7405-eng-48)
(UCRL-20165; Conf-710308-2) Avail: NTIS

Beam steering coils utilizing turns etched on printed-circuit boards were constructed and tested. The circuit-boards were rolled into a cylinder and inserted inside a short steel tube. Boards for vertical and horizontal steering were located in separated layers. Three coil sizes were constructed with inside diameters of 25 cm, 20.6 cm, and 17.3 cm respectively. The active length was 0.6 of the inside diameter in all cases. The coils produced an integrated deflection field in either the vertical or horizontal direction of approximately 316 Gauss-cm when excited with 5 A at approximately 30 V. The conductor pattern on the circuit-board was designed to produce a nearly uniform angular deflection for all rays transmitted, in spite of the short length/diameter ratio. The magnetic field integrated over a length of 152 cm was measured at several radii and azimuths. Values at 0.4 and 0.8 of bore radius were within approximately 0.5% and approximately 1.5% respectively of the central value. Suggestions for further refinement of deflection uniformity are presented. Author (NSA)

N71-32177# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Experimentelle Kernphysik.
A 12 cm BORE SUPERCONDUCTING DC QUADRUPOLE LENS
N. Fessler May 1970 11 p refs Presented at the 3d Intern. Conf. on Magnet Technol., Hamburg, 19–22 May 1970
(KFK-1218; Conf-700503-9) Avail: AEC Depository Libraries

An optimization with respect to a high solid angle acceptance in a parallel focus-target-doublet leads to the following parameters of the first quadrupole: straight length = 1m, warm bore = 12 cm, field at the circumference of the aperture = 30 kG. The winding concept is that of Beth, Sampson, Krueger and Snyder (BNL). The poles are wound with suitable, selected Nb3Sn tape. Improved winding techniques have been developed to get a mechanical solid structure. First experiments with one test pole and first measurements on the complete quadrupole are described. Author (NSA)

N71-32184*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
QUANTITATIVE DETERMINATION OF OPTICAL IMPERFECTIONS BY MATHEMATICAL ANALYSIS OF THE FOUCAULT KNIFE-EDGE TEST PATTERN
Samuel Katzoff Washington Aug. 1971 51 p refs
(NASA-TN-D-6119; L-7439) Avail: NTIS CSCL 20F

An integral expression for the distribution of light intensity across the image of a lens or mirror when it is tested by the Foucault knife-edge method was modified for analyzing image distortions in orbiting telescope mirrors. The linearized form of this expression is inverted so that the errors in the figure can be determined quantitatively from measurements of this light intensity distribution. Essentially, the method consists of making a Fourier analysis of the deviation of the light intensity from that for a perfect lens or mirror and then summing the errors corresponding to the different terms of the Fourier series. The method is developed both for mirrors (or lenses) without central obscurations and for mirrors with central obscurations (Cassegrain type). Calculated examples of several cases for both types are included. Author

N71-32236 Pennsylvania Univ., Philadelphia.
CURRENT DISTRIBUTIONS IN CYLINDRICAL GEOMETRIES
Wallace David Kesselman (Ph.D. Thesis) 1969 201 p
Avail: Univ. Microfilms Order No. 70-16171

Laplace's equation for various boundary conditions is solved for two different electrode configurations: the isolated disc electrode, and a cylinder wall. For the geometry involving a disc in an infinite plane, integral transform methods are used to obtain analytic solutions for the current density (J) and potential (V) distributions, for the four limiting cases of: (1) uniform V disc insulating plane; (2) uniform J disc insulating plane; (3) uniform J disc uniform V plane; and (4) uniform V disc uniform V plane. Examples of applications of results are drawn from electrochemical engineering problems related to fuel cell design, corrosion enhancement due to inclusion, and rotating disc systems. Furthermore, a conducting disc in an infinite insulating plane is treated for a linear current density-overpotential relation, yielding a description of current and potential distribution in terms of a set of singular Fredholm integral equations. Dissert. Abstr.

N71-32379 Vanderbilt Univ., Nashville, Tenn.
A PROBLEM IN THE QUANTUM THEORY OF MEASUREMENT
David Alexander Burba (Ph.D. Thesis) 1970 230 p
Avail: Univ. Microfilms Order No. 70-16416

The probability that a particle with a given initial wave function will be in a given volume at least one time between two distinct fixed times is calculated. Four main approaches to solving the counting-probability problem are discussed. One of these approaches involves assuming that the counter accomplishes the necessary collapse of the particle's wave function by acting as a black or absorbing sphere. Two black-sphere methods are discussed: 1) the use of a negative imaginary potential to obliterate the particle's wave function in the volume of the counter, and 2) direct obliteration of some of the outgoing components of the particle's wave function without trying to write a Hamiltonian to produce the effect of absorption. Hamiltonian methods are considered which explicitly involve interaction of the particle with a counter system which has its own degrees of freedom. An attempt is made to represent the case of a continuous observation by breaking the relevant time interval up into equally-spaced instants separated by intervals of duration, and assuming that the counter is turned on instantaneously at each of the instants. Dissert. Abstr.

N71-32546 Illinois Inst. of Tech., Chicago.
ELASTIC WAVE PROPAGATION AND SCATTERING IN QUARTER-SPACES
Lester William Schmerr (Ph.D. Thesis) 1970 282 p
Avail: Univ. Microfilms Order No. 70-17258

Two-dimensional elastic quarter-space problems, where the horizontal surface is struck by a line load of arbitrary time dependence and the vertical boundary is pressed against a fixed, rigid wall, are considered. The SH-wave case, when the line load acts tangential to the surface and the vertical wall is rigidly clamped, is solved exactly by the method of images. The complete dynamic solution is given and the long time (static) limit is found. Numerical results are presented for the transient shear stress exerted on the vertical wall. When the line load acts normal to the horizontal surface, the vertical boundary is assumed to be either rigid-smooth (RS) or rigid-clamped (RC). The RS case is solved exactly by the method of images. In the RC problem, Fourier Sine and Cosine transforms are applied and lead to a set of coupled, singular integral equations which are solved iteratively. Dissert. Abstr.

N71-32594# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MULTIPLE-WAVE INTERFEROMETERS
I. V. Skokov 29 Jan. 1971 244 p refs Transl. into ENGLISH from Mono Mnogoluchevye Interferometry (Moscow), 1969 p 1–151 p 170–247
(AD-723541; FTD-HC-23-615-70) Avail: NTIS CSCL 20/6

The paper is devoted to a description of the circuit diagrams, structural design and methods of application of multiple-wave interferometers of the Fabry-Perot type for studying processes and phenomena in transparent media located between the interferometer mirrors. Various multiple-wave interferometer schematics, basic types of light sources, methods and devices (monochromators) for obtaining narrow spectral lines, structural designs of interferometers, methods of exact adjustment and devices for realizing them, problems of interferogram processing techniques and equipment and methods of decoding them, and methods of recording the interference pattern are investigated. Methods are described for using multiple-wave interferometers for determination of stresses in transparent models, quality control of optical parts, plasma diagnostics, investigation of the parameters of gaseous substances, gas dynamic processes in rarefied gases, the study of thin films, vibrations, and application of multiple-wave interference techniques and equipment for high-resolution spectroscopy and metrology. GRA

N71-32607 New York Univ., N.Y.
AN INTEGRAL EQUATION FORMULATION OF THE OPTICS OF SPATIALLY DISPERSIVE MEDIA
John Jaan Sein (Ph.D. Thesis) 1969 140 p
Avail: Univ. Microfilms Order No. 70-16104

The optics of linear media is formulated in terms of integro-differential equations. The dispersion relation for propagating waves and the boundary conditions evolve from a single self-consistent analysis. The Ewald – Oseen extinction theorem is shown to be of very general validity. The formalism is extended to spatially dispersive media. A self-consistent analysis is given for the optics of crystals in the frequency domain of isolated exciton absorption bands. The additional boundary conditions, which are necessary in such a case, appear as an extinction theorem for the total polarization field. The general theory is applied to the analysis of the reflectivity of CdS in the A-exciton absorption region. The calculated reflectivity is found to be in good agreement with the experimental measurements of Hopfield and Thomas. It is determined that the lifetime of the A-exciton in their experiments was substantially shorter than has been estimated from their theory. Dissert. Abstr.

N71-32619 West Virginia Univ., Morgantown.
SYNCHRONIZATION AND STABILITY ASPECTS OF THE GYROSCOPIC VIBRATION ABSORBER
John Edward Sneckenberger (Ph.D. Thesis) 1969 218 p
Avail: Univ. Microfilms Order No. 70-15265

Aspects of the gyroscopic vibration absorber (GVA) related to its effectiveness as a synchronous absorber were investigated, including analysis of GVA synchronization to improve linear synchronization and an examination of GVA response to actual application environments to determine conditions which could preclude unstable motion of the absorber. Emphasis was placed on the design, development, and testing of an experimental GVA. Theoretical considerations reveal that much of the nonlinearity of the structure-absorber system involves a parameter I sub E. The feasibility of proportioning certain absorber moments of inertia to experimentally eliminate this parameter is demonstrated. The resulting synchronization curve provides linear synchronization over a wide range of excitation frequencies. Experimental results provide considerable verification of basic GVA behavior. The ability of the synchronized GVA to remain tuned to the fundamental excitation frequency when subjected to certain complex excitations was also noted, primarily for the purpose of directing future theoretical study related to the question of GVA stability. Dissert. Abstr.

N71-32669 Pennsylvania Univ., Philadelphia.
SPECIFIC HEAT ANOMALIES IN IMPURE HEISENBERG FERROMAGNETS
Karl Richard Vogelsang (Ph.D. Thesis) 1969 164 p
Avail: Univ. Microfilms Order No. 70-16230

Due to a small concentration of weakly coupled impurities randomly distributed in a Heisenberg ferromagnet, a specific heat anomaly is found at low temperatures. To calculate this effect the retarded Green's function technique was employed to obtain the transverse and longitudinal correlation functions which appear in the average magnetic energy. Equations of motion were decoupled for the spin operators using the random phase approximation and kept terms linear in the impurity concentration. The specific heat was found by differentiating the average energy with respect to temperature. A thirty-seven percent increase in the specific heat was found for a one percent concentration of impurities at about one-tenth the Curie temperature for impurities which are one-tenth as strongly coupled to their neighbors as host sites. The decoupling scheme also produced the correct initial T(5/2) temperature dependence of the average energy in the impure system. Dissert. Abstr.

N71-32716 New York Univ., N.Y.
MULTIPLE CHANNEL POTENTIAL SCATTERING AND SIMPLE SCATTERING BY AN INHOMOGENEOUS MEDIUM OR BY A POTENTIAL. PART 1: MULTIPLE CHANNEL SCATTERING THROUGH SPECTRAL REPRESENTATIONS. PART 2: LOW ENERGY SCATTERING BY AN INHOMOGENEOUS MEDIUM AND BY A POTENTIAL
Chris Rorres (Ph.D. Thesis) 1969 72 p
Avail: Univ. Microfilms Order No. 70-16097

The multiple channel scattering of a quantum mechanical particle in three dimensional space was considered in part 1. The scattering process was analyzed by utilizing the spectral or functional representations of the Hamiltonian operators involved. An integral equation that the scattering operator was to satisfy was derived, and from it certain properties of the scattering process were ascertained. Using the same techniques, the case of two identical particles acted upon by a fixed central potential and a small interaction potential was also treated. The scattering of a plane wave by an inhomogeneous medium or by a potential was considered in part 2. An integral equation for the scattered wave was derived in both cases and an iteration scheme was employed to obtain a formal solution to it. The scattered wave was shown to be a power series in k, the wave number of the incident wave, about the origin. Dissert. Abstr.

N71-32745# Lockheed Missiles and Space Co., Palo Alto, Calif.
OPTICAL HETERODYNING THROUGH A TURBULENT ATMOSPHERE
V. I. Vaitsel' 1971 4 p refs Transl. into ENGLISH from Radiotekh. i Elektr. (USSR), v. 16, no. 2, 1971 p 439 – 442
Avail: NTIS: National Translations Center, John Crerar Library, Chicago, Ill. 60616

The strong degrading influence of atmospheric turbulence on the reception of optical signals by a heterodyne method is considered. The main result shows that an increase in the receiving aperture over the diameter defined by the radius of correlation of the radiation is practically useless. This deduction is valid when the ratio between the mean signal power and the shot noise power is chosen as the efficiency criterion. The possibility of diminishing the influence of atmospheric distortions because of the passage of a reference beam through the same inhomogeneities as the signal is analyzed. Physically such a possibility results from the fact that a heterodyne receiver is responsive just to the difference in phases of the reference and signal fields, while amplitude fluctuations diminish because of the averaging effect of the aperture. It is shown that an increase in the signal to noise ratio due to the coherent component is achieved because of an increase in the coefficient of correlation between the reference and signal rays. Passage of the reference through the atmosphere is associated with holographing through a random medium. Author

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N71-31702# Brown Boveri/Krupp Reaktorbau G.m.b.H., Koeln (West Germany).

TONAGRID: A MONTE CARLO PROGRAM FOR CALCULATION OF NEUTRON AND PHOTON TRANSPORT IN DUCTS [TONAGRID: EIN MONTE-CARLO-PROGRAMM ZUR BERECHNUNG DES NEUTRONEN- UND PHOTONEN-TRANSPORTS IN DURCHBRUECHEN]

H. Zimmermann, D. Platthaus, and R. Dietrich Bonn Bundeswehramt Nov. 1970 46 p refs In GERMAN; ENGLISH summary sponsored by Bundesmin. fuer Verteidigung

(BMVg-FBWT-71-9) Avail: NTIS; Bundeswehramt, Bonn: 25 DM

TONAGRID is a computer program that calculates the transport neutrons, photons, and secondary photons through a plane multilayer slab, in which there is a duct of one of the following types: straight cylindrical duct, straight rectangular duct, straight duct of cylinder type, and bent duct. The calculation is done by the Monte Carlo method. ESRO

N71-31717# McDonnell-Douglas Astronautics Co., St. Louis, Mo.

THEORETICAL STUDY OF ELECTRON ATTACHMENT PHENOMENA Final Report, 15 Dec. 1969 – 15 Dec. 1970

Ronald L. Cowperthwaite and Howard Myers 15 Feb. 1971 87 p refs

(Contract F19628-70-C-0134)

(AD-723642; AFCRL-71-0113) Avail: NTIS CSCL 7/4

The report presents the results of a theoretical investigation of the attachment of electrons to molecules with the formation of negative ions. Two major areas were studied: The mechanism of electron attachment, and Neutral atom stripping reactions. A phenomenological model of the attachment cross section was developed and employed to establish criteria for the use of attaching compounds to reduce boundary layer plasmas. In order to check the attachment model with experimental data, a convolution analysis of electron impact experiments was formulated. The analysis of beam energy resolution led to a study of energy dispersion in cross beam experiments and to the conceptual design of a negative iodine ion beam experiment. The potential degradation in the efficiency of electron attachment due to the reactivity of atomic oxygen was assessed through the formulation of a reaction cross section model for atom stripping. Author (GRA)

N71-31721# Pittsburgh Univ., Pa. Dept. of Physics.

ELECTRON AND NUCLEAR SPIN INTERACTIONS IN SOLIDS Final Report

Frederic Keffer 16 Apr. 1971 13 p refs

(Grant AF-AFOSR-1678-69)

(AD-723327; AFOSR-71-1056TR) Avail: NTIS CSCL 20/12

Objectives achieved in this joint experimental and theoretical project include an enhanced understanding of the ferromagnetism of rare-earth hydrides and also of rare-earth metals; a new theoretical echo expansion technique for studying disordered materials; a mapping of the electron charge density in the semimetal arsenic; the discovery of an experimental multiple-pulse technique in nuclear magnetic resonance which reduces the effective instrumental time resolution to zero and allows extremely accurate measurement of relaxation parameters; a measurement of the proton correlation time in ice; a study of spin-lattice relaxation of nuclei in antiferromagnets and of spin diffusion in magnetically doped calcium fluoride; and a calculation of proton relaxation in hydrogen sulfide. Author (GRA)

N71-31724# Wisconsin Univ., Madison. Theoretical Chemistry Inst.

TRANSPORT PROPERTIES OF A GAS OF DIATOMIC MOLECULES. 2: RDW APPROXIMATION TO THE ROTATIONAL RELAXATION TIME

Richard D. Olmsted and C. F. Curtiss 6 Nov. 1970 29 p refs

(Grant NSF GP-12832)

(PB-198666) Avail: NTIS CSCL 07D

A quantum mechanical expression for the relaxation time is obtained for a low density gas of rotating diatomic molecules. The development is based on the restricted distorted wave approximation to rotationally inelastic scattering. The particular case of a gas of rigid spheres with embedded point dipoles is discussed. The classical limit of this result is also determined and agrees with the result obtained by another method. Author (GRA)

N71-31748# Naval Scientific and Technical Information Centre, Orpington (England).

MAGNETIC ANALYSIS OF A BEAM OF POSITIVE IONS, ACCELERATED BY A VOLTAGE OF 5-30 kv, AFTER PASSING THROUGH AN INERT GAS

N. V. Fedorenko Mar. 1971 24 p refs Transl. into ENGLISH from Zh. Tekhn. Fiz. (Leningrad), v. 24, no. 5, 1954 p 769–783

(AD-723588; NSTIC-29477; NSTIC-TRANS-2011) Avail: NTIS CSCL 7/4

A beam of ions, monochromatic in composition and energy, was passed through a gas and analyzed in a magentic field. Beams were studied which consisted primarily, of the atomic ions: single-charged (He (+), N (+), Ne (+), K (+), Ar (+), Ca (+), I (+), Ba (+), Pb (+), Bi (+)), double-charged (N (++) Ar (++), Ba (++)), triple-charged Ar (+++) and single-charged molecular ions (H (+)2, H (+)3, N (+)2). It became clear that such inelastic processes, linked to changes in the c/m of the ions in the beam, occur in single instances of a collision between an ion and a helium, neon, argon or krypton atom, or a hydrogen or nitrogen molecule. For single-charged atomic ions the existence of a process of breaking away of a single electron from the ion casing has been established (stripping of ions). Cross-section of the process is greater for ions of heavy elements. An evaluation was carried out of the effective cross-section of the ions H (+)2, H (+)3, N (+)2. Author (GRA)

N71-31753# United Aircraft Corp., East Hartford, Conn. Research Labs.

INFLUENCE OF COLLISION CROSS-SECTIONS FOR ELECTRONS, ATOMS AND MOLECULES ON ROCKET EXHAUSTS AND METASTABLE PROPELLANTS Final Report, 1 Mar. 1966 – 31 Mar. 1971

H. Harvey Michels Mar. 1971 13 p refs

(Contract AF 49(638)-1711)

(AD-723316; UARL-K920611; AFOSR-71-1211TR) Avail: NTIS CSCL 7/4

The research discussed was directed toward the analysis of collisional processes involving electrons, ions, and neutral particles. Collisional processes have long been recognized as being of substantial interest as basic physical processes and in a number of engineering applications, particularly in the fields of propulsion and power generation. Experimental data currently available at thermal energies is limited and difficulties are frequently encountered in making exact measurements. Therefore, a theoretical approach to predict kinetic cross-sections is desirable. Research was performed in the areas of elastic scattering, inelastic scattering and atomic collisions. A chronological list is provided of the 11 publications and 25 verbal presentations resulting from the program. Author (GRA)

N71-31792# Nuklear-Chemie und -Metallurgie, G.m.b.H., Wolfgang bei Hanau (West Germany).

TARGETS FOR NEUTRON GENERATORS [TARGETS FUER NEUTRONFNGENERATOREN]

H. Fabian Bonn Bundeswehramt Nov. 1970 36 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung

(BMVg-FBWT-F1-8) Avail: NTIS; Bundeswehramt, Bonn: 25 DM

The development work on solid and gaseous tritium targets having a high thermal capacity, a long lifetime, and a high specific neutron yield, is described. The targets prepared have a thermal resistance up to 450 C, a neutron yield increase of 15%, and a tritium reservoir to prolong target lifetime. Gas targets have also been developed. Special devices are mentioned for target-holding, moving, transportation, and storage. ESRO

N71-31803# Naval Scientific and Technical Information Centre, Orpington (England).

SOLID MULTILAYER TRITIUM TARGETS FOR A NEUTRON GENERATOR

L. N. Katsaurov Mar. 1971 6 p refs Transl. into ENGLISH from Prib. Tekh. Eksp. (Moscow), no. 4, 1968 p 35-36

(AD-723592; NSTIC-29542; NSTIC-TRANS-2089) Avail: NTIS CSCL 20/7

The results are given of an experimental study of a solid three-layered tritium target for use in a D-T neutron generator. As compared with a conventional target this target gives an approximately tenfold decrease in the D-D neutron yield, which greatly improves the monochromaticity of the neutron flux. Author (GRA)

N71-31804# Hamburg Univ. (West Germany).

SINGLE PHOTOPRODUCTION OF PION(-) ON NEUTRON AT PHOTON ENERGIES BETWEEN 0.2 AND 2 GeV [PHOTOEINFACHPRODUKTION VON PI-MESONEN AM NEUTRON BEI PHOTOENERGIEN ZWISCHEN 0.2 UND 2 GeV]

Harald Butenschoen (Ph.D. Thesis) 1970 129 p refs In GERMAN

Avail: NTIS

The photoproduction of negative pions in the reaction: photon deuteron yields photon photon negative pion is studied. The observer model is used to determine effective scattering cross sections on the neutron by treating low energetic protons as observers in the reaction: photon neutron yields photon negative pion. Total and differential effective scattering cross sections for photon energies between 0.2 and 2 GeV at gravity point angles between 20 deg and 160 deg are obtained. Legrendre polynomials and a Moravcsik fit are used to determine the different effective cross sections at the various energies. Resonance effects at (P sub 33(1236)) and at D sub 13 (1525) confirm earlier observations of single pion photoproduction. Transl. by G.G.

N71-31892# Gosudarstvennyi Komitet Po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Fiziko-Energeticheskii Inst.

SPINNING TOP PROBLEM IN QUANTUM MECHANICS [K PROBLEME VOLCHKA V KVANTOVOI MEKHANIKE]

E. V. Gai 1970 7 p refs In RUSSIAN

(FEI-203) Avail: AEC Depository Libraries

The problem of constructing wave functions of an asymmetrical spinning top quantum mechanics is reviewed. It is demonstrated that the functions can be derived from spherical-conical wave functions with the aid of the appropriate operators for the increasing (decreasing) of the projection of the gyroscope's moment onto an external axis. It is also shown that the operators of projections of the gyroscope's moment constitute generators for the motions of a point in the third sphere. Author (NSA)

N71-31899# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).

IMPACT PICTURE AND THE EIKONAL APPROXIMATION

Hung Cheng and Tai Tsun Wu Feb. 1971 16 p refs

(Contract AT(30-1)-4101; Grant NSF GP-13775)

(DESY-71/6) Avail: NTIS

A detailed study of the phi cube-theory shows that the impact picture is correct, while the eikonal approximation is not valid. A relatively simple experimental test of the impact picture is discussed. Author (NSA)

N71-31926# Akademiya Nauk URSR, Kharkov. Fiziko-Teknicheskii Inst.

STRUCTURE OF ELECTRON CLUSTERS IN AN INJECTOR WITH A STEP-LIKE VARYING WAVE PHASE VELOCITY

V. A. Vishnyakov, I. A. Grishaev, V. M. Grizhko, V. I. Kolosov, V D. Krasnikov et al 1970 11 p refs In RUSSIAN

(KHFTI-70-17) Avail: AEC Depository Libraries

Theoretical and experimental data are given on the structure of clusters formed by injection with a step-wise variable wave-phase rate. The possibility of improving the efficiency parameters of the 2 GeV electron accelerator by using an injector with step-wise varying wave-phase-rate is discussed. Author (NSA)

N71-31949# Institute of Nuclear Research, Warsaw (Poland).

SUBNANOSECOND TIMING IN NUCLEAR SPECTROSCOPY

M. Moszynski 1970 211 p refs In POLISH; ENGLISH summary

(INR-1213) Avail: AEC Depository Libraries

Timing properties of nuclear radiation detectors used in subnanosecond half-lives measurements are studied. A detailed study of timing properties of a scintillation consisted of XP1021 photomultiplier and a Naton 136 or Ne111 scintillator with different dimensions are presented. The study gives an explanation of a time spread mechanism of the scintillation counter and, in particular, it removes a disagreement between experiments and the theory of timing. A time resolution of 132 ps for Co-60 has been obtained using Ne111 scintillators with 2.5 cm diameter and 1.0 cm height. Also, the timing properties of semiconductor detectors are described. In particular, the study of a time resolution obtainable with a surface barrier detector for alpha-particles shows that a plasma effect gives an essential contribution to the time spread of the detector. Author (NSA)

N71-31950# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).

RELATIVISTIC SCALAR QUARK MODEL WITH STRONG BINDING

M. Boehm, H. Joos, and M. Krammer Mar. 1971 37 p refs

(DESY-71/10) Avail: AEC Depository Libraries

The dynamics of strong binding of heavy scalar particles (quarks) are discussed with the help of the Bethe-Salpeter equation with a smooth ladder type kernel. For this purpose the Bethe-Salpeter amplitudes are expanded into O(4) spherical functions and the remaining hyperradial equation is solved by a variational method. These calculations are considered as a model of mesons as bound states of heavy quarks. The low lying mesons form linear trajectories with a slope of 1 Ge/Vsquared. The modification of the vector meson dominance form factor by the bound state wavefunctions is calculated and found to be in good agreement with experiment. Author (NSA)

N71-31961# Academy of Sciences (USSR), Moscow. Inst. of Atomic Energy.

DURATION OF CHARGED PARTICLES CONTAINMENT IN A TRAP WITH MAGNETIC MIRROR

D. V. Sivukhin 1970 47 p refs In RUSSIAN

(IAE-1872) Avail: AEC Depository Libraries

A simplified problem on the duration of charged-particle containment in a trap with magnetic mirrors is reduced to the solution of the kinetic equation in the center of the trap. The magnetic and electric fields are determined from the kinetic equation and their influence is taken into account by the boundary conditions for the distribution function. The kinetic Landau equation is used for resolving the problem of Coulomb scattering of the light particles by heavy particles in traps with magnetic mirrors. Formulas are obtained for the mean time of light particle containment. With additional physical factors, a formula was obtained for the mean time of containment of ions of real plasma in the trap. The latter almost coincides with Budker's formula. (NSA)

N71-31962# Academy of Sciences (USSR), Moscow. Inst. of Atomic Energy.

EXPERIMENTAL LIMITATIONS OF THE METHOD OF MERGING BEAMS FOR STUDYING ION ATOM COLLISIONS

V. A. Belyaev 1970 23 p refs In RUSSIAN

(IAE-2001) Avail: AEC Depository Libraries

Data from experimental studies of ion–atom collisions show the efficiency and feasibility of further development of the method of merging beams. The details of the method and results achieved are discussed. (NSA)

N71-31964# Central Electricity Generating Board, Berkeley (England). Nuclear Labs.

BUBBLE MOBILITY ON DISLOCATIONS AND RANDOM DIFFUSION STUDIES

W. B. Beere Dec. 1970 20 p refs

(RD/B/N-1850) Avail: AEC Depository Libraries

Krypton and helium bubbles were precipitated on dislocations in copper foils and the root mean square migration distances measured during isothermal annealing. Helium bubbles either remained fixed, coalesced, or migrated to the foil surface. Krypton bubbles showed a maximum in the root mean square migration distance for bubbles of 7 nm radius. The effects of bubble pinning and coalescence upon migration distances were calculated and, together with the effect of correlation of surface atomic jumps, were compared with experimental observations. It was shown that previous expressions for the mobility do not adequately describe the experimental root mean square random migration distances. Author (NSA)

N71-31967# Australian National Univ., Canberra. Research School of Physical Sciences.

BEAM OPTICS CALCULATIONS FOR CYCLOTRON-TANDEM INJECTION SYSTEM

P. B. Treacy [1971] 14 p refs

(ANU-P-519) Avail: AEC Depository Libraries

A summary of calculations made on beam trajectories with focusing elements to be placed between the present EN tandem accelerator and a future negative-ion cyclotron at ANU is given. Calculations are dependent on cyclotron beam phase space characteristics. A simplified Gaussian optics analysis is given and the lens layout is described. The proposed injection system is considered suitable provided an aperture of about 0.5 in. is inserted in the 20 deg magnet. NSA

N71-31969# Technische Univ., Berlin (West Germany). Inst. fuer Kerntechnik.

REVIEW OF METHODS FOR HANDLING OF STATIONARY NEUTRON TRANSPORT PROBLEM [UEBERSICHT UEBER METHODEN ZUR BEHANDLUNG VON STATIONAEREN NEUTRONEN-TRANSPORT-PROBLEMEN]

Erwin Lindauer Oct. 1970 268 p refs In GERMAN

(TUBIK-21) Avail: AEC Depository Libraries

An instruction program and workbook for the review of the methods for the treatment of neutron transport problems are presented. The topics considered are the Boltzmann equation, simplification of the transport equation, P sub 1 diffusion, and group diffusion approximations. One, two, and multigroup diffusion calculations, source iteration and Fermi approximation, synthetic method of source iteration as eigenvalue problem, methods with discretization of the angle, and moderator nucleus are also treated. NSA

N71-31970# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.

ENERGY LEVELS OF THREE PARTICLE SYSTEM

V. I. Ovcharenko, I. V. Simenog, and G. F. Filippov 1970 72 p refs In RUSSIAN; ENGLISH summary Presented at 20th Conf. on Nuclei, Leningrad, Jan. 1970

(ITF-70-100-P; Conf-700117-1) Avail: AEC Depository Libraries

Bound states of the three-particle system are studied by the method of reciprocal interaction parameter expansion. The dependence of energy levels, mean-square radii, and other physical quantities of the system on the interaction parameter is investigated. A complete set of zero-approximation Hamiltonian eigenfunctions is proposed. The basic functions of a number of low states are given explicitly. With these functions, matrix elements are calculated and expressions for energies and mean-square radii of the bound states of the three-particle system are found as a sum of the first several terms of the series in reciprocal of the interaction parameter. In conclusion, the dependence of energy levels and mean-square radii on the interaction parameter is discussed in detail. Author (NSA)

N71-31971# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.

ON THE MODEL HAMILTONIAN OF THE THEORY OF SUPERCONDUCTIVITY

D. Ya. Petrina and V. P. Yatsishin 1970 21 p refs Presented at the 3d Conf. on Stat. Phys. and Phys. Kinetics, L'vov, Jun. 1970

(ITF-70-90-E; Conf-700648-3) Avail: AEC Depository Libraries

The model Hamiltonian of the theory of superconductivity in an infinite volume is investigated for the excited states. It is proved that the model Hamiltonian coincides with the approximation one. The meaning of the approximation Hamiltonian in an infinite volume is specified on the excited states. The correlation functions at zero temperature and infinite volume are defined. Author (NSA)

N71-31972# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.

MULTIPOLE ANALYSIS OF THE POLARIZATION PHENOMENA AT THE FAST NUCLEON SCATTERING BY NUCLEI

A. G. Sitenko and A. D. Fursa 1970 15 p refs In RUSSIAN

(ITF-70-87-P) Avail: AEC Depository Libraries

Polarization and asymmetry from elastic and inelastic nucleon scattering by C-12 with distortion due to the spin–orbit interaction taken into account are considered on the basis of the multipole formalism developed earlier for describing nucleon scattering by nuclei. The optical potential and its parameters are obtained from the nucleon–nucleon interaction in accordance with multipole scattering theory. The numerical calculations and comparison with experimental data are carried out for the elastic scattering as well as for inelastic proton scattering with the excitation of the 2(+)T = 0(4.44 MeV) and 3(−)T = 0(9.64 MeV) states of C-12. Author (NSA)

N71-31973# Akademiya Nauk URSR, Kharkov. Inst. Teoreticheskoi Fiziki.

ON A MODEL OF THE EXPANDING UNIVERSE

G. V. Wataghin 1970 11 p refs

(ITF-70-105-E) Avail: AEC Depository Libraries

The evolution of the expanding universe is interpreted as a uniform 4-dimensional dilatation of space–time and the corresponding contraction of momentum–energy parameters. A simple interpretation of the Hubble effect is obtained. Author (NSA)

N71-31975# Academy of Sciences (USSR), Moscow.
RADIATION EFFECTS ON DYNAMICS OF RELATIVISTIC ELECTRON RINGS
A. A. Kolemenskii 1970 28 p refs In RUSSIAN
(NP-18634) Avail: AEC Depository Libraries

Consideration is given to the general problem of how radiation emission effects can be used to improve the characteristics of electron rings and to increase the acceleration efficiency. In addition to an induced (betatron) electric field, systems with a high frequency field are also considered. Thus the results can be applied to the motion of electrons in other systems where the orbital radius and other parameters vary substantially (ring phasotrons, certain types of accumulators, etc.). The equation of motion of an electron in the presence of synchrotron radiation is given for a relativistic case. Expressions are given for the nonequilibrium motion of the radiation-emitting electron. Radiation compression of a ring takes place relatively slowly (on the order of milliseconds or longer), if strong magnetic fields are not involved. The radiation emission effects can be used to form electron rings having optimal parameters. NSA

N71-31994# California Univ., Berkeley. Lawrence Radiation Lab.
SOME CONSIDERATIONS IN PLANNING FOR SUPERHILAC TIMESHARE OPERATION WITH BOTH HEAVY AND LIGHT ION BEAMS
Frank B. Selph Mar. 1971 9 p refs Presented at The Natl. Particle Accelerator Conf., Chicago, 1 Mar. 1971
(Contract W-7405-eng-48)
(UCRL-20633; Conf-710308-10) Avail: NTIS

The possibility of timeshare operation, of particle accelerators in which two or more experimental setups can be supplied with beam at the same time is discussed. The SuperHilac will accelerate ions of all mass numbers, with final energy continuously variable from 2.6 to 8.5 MeV/nucleon. In order to change particle and energy in the Hilac, a careful retuning of many machine parameters and (optimistically) an hour of machine time is required. For the SuperHilac it is proposed to provide particles of different charge-to-mass ratio on alternate pulses, so that, for example, half of the pulses would be light ions, delivered to one experimental area, and the other half heavy ions, delivered to another experimental area. Consequently a number of new problems need to be solved. These occur at injection, with accelerating and focusing the beams in the linac, in the stripper area, and at the exit from the machine. Author (NSA)

N71-31996# California Univ., Berkeley. Lawrence Radiation Lab.
NON-INTERCEPTING MONITOR OF BEAM CURRENT AND POSITION
Robert T. Avery, Andris Faltens, and Edward C. Hartwig Feb. 1971 3 p refs Presented at the Natl. Particle Accelerator Conf., Chicago, 1 Mar. 1971
(Contract W-7405-eng-48)
(UCRL-20166; Conf-710308-3) Avail: NTIS

A compact monitor was developed which measures beam current and beam position without intercepting or appreciably affecting the particle beam being measured. It is a broad band device which prevents the development of beam disturbing resonant modes. The monitor consists of a resistive band inserted in the beam pipe wall with connections for reading the voltage across the band in each vertical and horizontal axis intercept. For pulsed or RF beams, return current equal in magnitude to the beam current flows on the beam pipe inside wall and through the resistive band. If the beam is centered, equal voltage appears on all four monitor connections. If the beam is off-center, the return currents are unsymmetrical and unequal voltages appear at the monitor connections. Beam current is proportional to the sum of all monitor voltages, while beam position is approximately proportional to the difference in voltage at opposing monitors. Tests and operating experience confirm its operation. Author (NSA)

N71-32042# Democritus Nuclear Research Center, Athens (Greece).
MEASUREMENT OF THE COEFFICIENT OF GAMMA ABSORPTION OF MATERIALS USED FOR NUCLEAR CONSTRUCTIONS [MESURE DU COEFFICIENT D'ABSORPTION GAMMA PAR DES MATERIAUX UTILISES AUX CONSTRUCTIONS NUCLEAIRES]
E. Mavroyannakis and J. Antoniades Jul. 1970 15 p refs In FRENCH
(DEMO-70/11) Avail: AEC Depository Libraries

An experimental device for the measurement of the gamma absorption cross section was described. The radiation sources used and the measurement techniques are discussed. The values of absorption coefficients measured for Cd, Al, 18/8 stainless steel, Fe, UO_2, Si, Sb, Pb, Ni, Plexiglas, paraffin, paraffin Bi, bitumen, teflon, gum, marble, and porcelain are tabulated and compared with theoretical values when possible. NSA

N71-32043# Vrije Univ., Amsterdam (Netherlands).
INTERNAL SOURCE SCINTILLATION SPECTROMETRY ON NUCLIDES DECAYING BY ELECTRON CAPTURE
Willem Goedbloed (Ph.D. Thesis) 20 Feb. 1970 62 p refs
(NP-18692) Avail: AEC Depository Libraries

Orbital-electron-capture ratios and electron-capture-to-positron-emission ratios were studied with an internal source scintillation method. An account of theory is given with emphasis on the information that may be derived from these ratios. Important developments both in theory and experiment from 1963 till now are surveyed. In order to obtain significant results experimental accuracies of a few percent are required; a discussion of detectors that may fulfill these accuracy requirements is given. Since proportional counters and internal-source scintillation crystals are capable of detecting both X-rays and Auger electrons, they are generally used in this field. The spectrometers used in the measurements consist of two parts, which are called source crystals and enveloping crystals, respectively. The source crystals are obtained from the melt by a crystal growing procedure. In that way the source atoms are dispersed through the volumes of the alkali halide scintillators. Various enveloping crystal constructions are investigated. Author (NSA)

N71-32044# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
MONOCHROMATIC METHOD FOR MEASUREMENT OF THE MEAN PROTON ENERGY IN 665 MeV BEAM USING THE VAVILOV-CHERENKOV RADIATION
V. P. Zrelov, M. A. Mustin, P. Pavlovic, P. Sulek, and R. Janik 1971 25 p refs In RUSSIAN
(JINR-P13-5636) Avail: AEC Depository Libraries

The monochromatic method of measurement of the proton energy using the Vavilov–Cherenkov radiation and the interference filters with mean wavelength ~ 6000 A and pass band Delta wavelength ~ 100 A is described. The results of testing this method on the 665 MeV proton beam extracted from a synchrocyclotron are presented. The measurement accuracy of + or – 0.02% is achieved which exceeds the accuracy of the best previously known methods by 5 times. Author (NSA)

N71-32052# Purdue Univ., Lafayette, Ind. Project Squid Headquarters.
ANALYSIS OF SYMMETRY IN CHEMICAL REACTIONS

Thomas F. George and John Ross Apr. 1971 60 p refs Prepared in cooperation with MIT
(Contract N00014-67-A-0226-0005; Proj. Squid)
(AD-723797; SQUID-TR-MIT-57-PU) Avail: NTIS CSCL 7/4

The authors investigated the effect of the symmetry of the electronic and nuclear motion in chemical reactions. The analysis focuses on concerted reactions which are defined to be describable by a single transition matrix. The transition matrix for rearrangement collisions is derived in a quasiadiabatic representation of electronic motion such that the electronic degrees of freedom of reactants and products can be defined separately. Three alternative forms are obtained for the transition matrix from which symmetry rules are derived. Five approximations are applied: Separate conservation of total electronic spin; Neglect of virtual electronic transitions; Born-Oppenheimer approximation; Fixed nuclear configuration; Franck-Condon-type approximation; Neglect of remaining effects of dynamics. The five approximations lead to an expression for the transition matrix from which Shuler's rules and the Woodward–Hoffmann rules follow by application of the Wigner-Eckart theorem. The inapplicability of one or more of these approximations are discussed. Physical reasons are presented for the wide applicability of the Woodward–Hoffmann rules. It is suggested that the 'principle of maximum bonding' proposed by Woodward and Hoffmann is a useful rule, but not supported by theory and experiment as a principle. Author (GRA)

N71-32053# Rutgers Univ., New Brunswick, N.J. Dept. of Physics.
AUTOMATIC TARGET CYCLING SYSTEM FOR TOTAL CROSS SECTION MEASUREMENTS
T. J. Devlin, J. T. McFadden (Princeton-Pa. Accelerator), and R. E. Mischke (Princeton Univ.) 10 Mar. 1971 14 p refs
(Contract AT(30-1)-4159; Grant NSF GP-14703)
(PURC-4159-7) Avail: NTIS

The construction and operation of an automatic target cycling system is described. It is designed to move three targets cyclicly into a particle beam for preset intervals which are proportional to the beam flux. The system has been successfully used in a measurement of n-p and n-d total cross sections. Author (NSA)

N71-32054# Kernforschungszentrum, Karlsruhe (West Germany). Lab. fuer Isotopentechnik.
PNEUMATIC SYSTEM FOR ACTIVATION ANALYSIS WITH SHORT-LIVED RADIONUCLIDES [ROHRPOSTANLAGE FUER AKTIVIERUNGSANALYSEN MIT KURZLEBIEN RADIONUKLIDEN]
R. Ehret, H. Domberg, and H. Lohner Oct. 1970 13 p In GERMAN; ENGLISH summary
(KFK-1293) Avail: AEC Depository Libraries

A rabbit system is described for activation analyses covering short-lived radionuclides, with particular reference to application to oxygen analyses with 14-MeV neutrons. There is no piping material between the sample and the neutron target. The distance may be set to a minimum of 2.5 mm. Sample and standard are transported in a single piping system. After activation, sample and standard are automatically separated from each other. Samples may be used in any form. Compact samples do not call for additional cladding during transportation. For constructional reasons, an interruption of about 4 sec is provided between irradiation and measurement and, similar to the period of irradiation, recorded automatically. A minimum expenditure is required to build the system (about DM 10,000.-). Author (NSA)

N71-32058# Institute of Nuclear Research, Warsaw (Poland).
ON THE INTERACTION OF HARMONIC OSCILLATORS WITH RADIATION FIELD
K. Rzazewski and W. Zakowicz 1970 18 p refs
(INR-P-1203) Avail: AEC Depository Libraries

The radiation of charged harmonic oscillators is investigated. Detailed classification of the states of oscillators from the point of view of their radiation is given. The superradiant behavior of certain states is derived. Exact solution to the problem of interaction with one mode in the lossless cavity is discussed. Author (NSA)

N71-32069# Vrije Univ., Amsterdam (Netherlands).
BETA-GAMMA CIRCULAR POLARIZATION CORRELATION MEASUREMENTS ON SOME ODD MASS NUCLEI
Jan Johan van Rooijen (Ph.D. Thesis) 1970 103 p refs
(NP-18694) Avail: AEC Depository Libraries

Beta-gamma circular polarization correlation measurements on transitions in several odd mass nuclei are reported. Some theoretical aspects of first order forbidden decay are outlined. Detection of circular polarization of gamma rays is generally accomplished by using the spin dependence of Compton scattering. The framework for the description of interactions of polarized beams of photons is reviewed, and various types of polarimeters are discussed. Beta-gamma circular polarization correlation measurements were performed on the 210-keV beta-279-keV gamma cascade in Hg-203; the results seem to be incompatible with the Coulomb approximation. Failure to obtain satisfactory fits to the data indicates that the data and the theoretical framework are not compatible. NSA

N71-32095# Kernforschungszentrum, Karlsruhe (West Germany).
NEW DEVELOPMENTS AND ASPECTS IN PHOSPHATE GLASS DOSIMETRY
E. Piesch Nov. 1970 29 p refs
(NP-18747; Rept-20/70-1) Avail: AEC Depository Libraries

In the past years a new method of differential fluorescence measurement was developed by which the glass is continuously scanned and a differential fluorescence intensity is measured and recorded directly as a function of the glass depth. By the new technique the radiation quality (10 to 600 keV) and the direction of the radiation incidence can be determined. Based on the results of extensive calibration exposures and phantom measurements new aspects of phosphate glass dosimetry are discussed, in particular the evaluation of radiation quality, the analysis of mixed radiation fields, the indication of the direction of the radiation incidence for frontal exposure and for exposure from behind, and the direct indication of the absorbed dose in the critical organs using an energy independent dosimeter with reduced influence of body orientation to radiation incidence. The advantages of the new dosimeter system are briefly discussed and compared to other dosimetric systems for personnel monitoring. Author (NSA)

N71-32096# Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Neutronenphysik und Reaktortechnik.
CALCULATION OF FLUX DISTRIBUTIONS IN REACTOR SUB+REGIONS WITH GENERALIZED MULTIPLE COLLISION PROBABILITIES
L. Mayer Nov. 1970 22 p refs
(EURFNR-898; KFK-1334) Avail: AEC Depository Libraries

The theory of multiple collision probabilities for one dimensional problems has been extended for handling thick zones and strongly anisotropic fluxes. This entails the treatment of space dependent scattering sources and anisotropic fluxes at the boundaries of subzones. For plane geometry anisotropic scattering sources have been included. A multigroup collision probability code STOWA based on the extended theory has been written. It may be used in connection with diffusion calculations or independently and may perform cell calculations or determine flux distributions in special layers of a reactor, also in the blanket or the shielding. Results are given and compared to other transport codes and measurements. Different approximations to angular scattering on hydrogen are evaluated with the code. Author (NSA)

N71-32100# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics.

THE (n,alpha) REACTION: A NEW CHANNEL FOR STUDYING THE NATURE OF NEUTRON RESONANCES

Yu. P. Popov 1970 22 p refs Presented at the Intern. Meeting on the Perspectives of Neutron Spectry., Dubna, USSR, Oct. 1970 (JINR-E3-5483) Avail: AEC Depository Libraries

The measurements of the (n,alpha) reaction cross sections and alpha-particle spectra in individual resonances performed in the Laboratory of Neutron Physics (JINR) showed the efficiency of further development of this branch of neutron spectroscopy. The results of the first studies of the (n,alpha) reaction on resonance neutrons, the problems to be solved by experimentalists and the perspectives of acquisition of new data on the nature of neutron resonances and parameters of the optical model are considered. Author (NSA)

N71-32101# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

EFFECT OF THE CHARGE ON Cf 252 FISSION FRAGMENTS ON THE NEUTRON EMISSION PROCESS [INFLUENCE DE LA CHARGE DES FRAGMENTS SUR LE PROCESSUS D'EMISSION DES NEUTRONS DE FISSION DU CF-252]

Herve Nifenecker (Ph.D. Thesis--Univ. of Paris, Orsay) Jan. 1971 166 p refs In FRENCH

(CEA-R-4121) Avail: AEC Depository Libraries

Simultaneous measurements of the X-ray emission, neutron emission, and kinetic energies of Cf-252 fission fragments were made. The charge, the total kinetic energy, and the neutron emission by the individual fragments were determined. For light fragments of charge between 40 and 46 and the complementary heavy fragments, the first and second moments of the kinetic energy and neutron number distributions were obtained. It was thus possible to deduce the proportions of excitation energy shared between the two fragments and to determine which part of the excitation contributed to the deformation energy of the fragments. The intrinsic excitation energy of the fragments, at scission, was found to be approximately 13 MeV; the pairing energy term associated with the parity of the proton number appeared mostly in the form of intrinsic excitation energy. The increase in excitation energy necessary for a fragment to emit an additional neutron was determined and indicated that, when the deformation energy of the fragments is high, conditions favor gamma ray emission rather than neutron emission. Author (NSA)

N71-32102# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation.

COMPUTATIONAL STUDY OF THE NON-LINEAR REGIME OF THE RADIATION INSTABILITY DEVELOPMENT OF THE RELATIVISTIC ELECTRON RINGS

A. G. Bonch-Osmolovskii, V. G. Makhenkov, V. N. Tsytovich, and B. G. Shchinov 1971 33 p refs In RUSSIAN

(JINR-P9-5622) Avail: AEC Depository Libraries

The instability evolution of a relativistic thin electron ring is numerically investigated. The results of the exact nonlinear equation, considering interactions of 10 harmonics of the coherent radiation, are obtained. Both the radiation effects and the negative mass effects for a ring in the free space are considered. Author (NSA)

N71-32103# Kernforschungsanlage, Juelich (West Germany). Zentralinst. fuer Angewandte Mathematik.

PROGRAM FOR SOLUTION OF THE STATIONARY NEUTRON TRANSPORT EQUATION WITH SPHERICAL SYMMETRY [EIN PROGRAMM ZUR LOESUNG DER STATIONAEREN NEUTRONENTRANSPORTGLEICHUNG BEI KUGELSYMMETRIE]

W. Hanke and E. Horlitz Jul. 1970 24 p refs In GERMAN

(JUL-683-MA) Avail: AEC Depository Libraries

The method, described for the treatment of the stationary neutron transport equation in spherical symmetry with the boundary condition that nothing flows into the reactor from the outside was programmed. In the method, an equation system is to be solved whose coefficients are three-dimensional integrals. The program is in two independent parts with a preliminary program which is described individually. An example is given of the use of the program. The program itself is given. NSA

N71-32104# Reactor Centrum Nederland, Petten.

AN EXTENSION OF THE DERIVATION OF THE DIFFUSION LENGTH FOR NEUTRONS IN A MEDIUM WITH SMALL ABSORPTION

H. H. Woldringh Jan. 1971 6 p ref

(RCN-134) Avail: AEC Depository Libraries

The explicit expression for the first-order correction of the diffusion length for neutrons in a medium with small absorption is derived. This constitutes an extension to the work of Davison, who gives an implicit equation for this correction. Author (NSA)

N71-32106# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Atomnoi Energii.

WAVE FUNCTION AND BOUND ENERGY OF NUCLEI H 3(He 3) TAKING INTO ACCOUNT THE TENSOR INTERACTION OF NUCLEONS [VOLNOVAYA FUNKTSIYA I ENERGIYA SVYAZI YADER H 3 (He 3) S UCHETOM TENZORNOGO VZAIMODEISTVIYA NUKLONOV]

B. M. Dzyuba, V. V. Pustovalov, V. F. Rybachenko, A. A. Sedovoi, and V. D. Efros 1970 20 p refs In RUSSIAN; ENGLISH summary

(IAE-2000) Avail: AEC Depository Libraries

The K-harmonics method is used to calculate the binding energy and the wave functions of H-3 and He-3. A system of ten equations is obtained, which takes into account all harmonics of the K = 0, 2, 4 values and all the L = 0, 1, 2 values. The solution of five equations (K = 0, 2, 4; L = 0; K = 2, L = 2) gives the H-3 binding energy for different forms and parameters of the potentials, which is small as compared with that calculated without tensorial forces. Approximate consideration of two more equations for the components of the function with K = 4, L = 2 increases appreciably the absolute value of the H-3 bound energy. The admixture of the mixed symmetry function is considerably reduced, which seems to create the problem of agreement of calculated values of the charge form factors H-3 and He-3 with experimental data. Author (NSA)

N71-32110# Ceskoslovenska Akademie Ved, Rez. Ustav Jaderneho Vyzkumu.

QUASI PARTICLE DESCRIPTION FOR INDIUM

R. Alzetta, M. Gmitro, and Y. K. Gambhir (Carnegie-Mellon Univ.) [1970] 31 p refs

(UJV-2540-F) Avail: AEC Depository Libraries

The quasiparticle model was applied to the description of the nuclear properties of the low-lying states of In isotopes. The Hamiltonian is diagonalized in the space obtained by coupling zero- and two-quasineutron configurations with the proton-hole states in nucleon + Z = 50 core, using a renormalized Tabakin interaction. The inclusion of two-hole one-particle proton configurations, consistent with the experimental findings in the Cd-114(He-3,d)In-115 reaction, in a weak coupling approximation in which the quasineutron excitation modes are first generated independently, and then coupled to the proton hole excitations to obtain the configuration space for the diagonalization work, is also studied quantitatively. The energy spectrum of the In-115 nucleus is calculated and discussed. Author (NSA)

N71-32113# Purdue Univ., Lafayette, Ind. Dept. of Physics.

BETA-GAMMA CIRCULAR POLARIZATION CORRELATION AND NUCLEAR MATRIX ELEMENTS

H. A. Smith and P. C. Simms 1971 27 p refs

(Contract AT(11-1)-1746)
(COO-1746-54) Avail: NTIS

The beta-gamma circular polarization correlation P sub gamma for the 2.41-MeV beta transition of As-76 was measured as an average value over the energy interval E sub beta = 1.4 to 2.0 MeV at an average angle phi sub beta gamma = 158 degrees. Previous experimental data, this new value for P sub gamma, and theoretical arguments are used to set limits on the nuclear matrix elements and to investigate the diagonality of the Coulomb hamiltonian. The analysis shows that matrix elements which change the angular momentum by 0, 1, and 2 units all contribute with approximately equal strength to the transition. The matrix element analysis indicates that the A sub 3 term in P sub gamma is negligible compared to the A sub 1 term. When A sub 3 is set equal to zero, the experimental data gives the following value for P sub gamma : P sub gamma (1.4 MeV < E sub beta < 2.0 MeV, phi sub beta gamma = 180 deg) = 0.105 + or - 0.02. Author (NSA)

N71-32119# California Univ., Berkeley. Lawrence Radiation Lab.
VACUUM CRYOPUMPING A HEAVY ION SOURCE IN A HIGH VOLTAGE TERMINAL
Richard Wolgast Feb. 1971 5 p refs Presented at Natl. Particle Accelerator Conf., Chicago, 1 Mar. 1971
(Contract W-7405-eng-48)
(UCRL-20620; Conf-710308-12) Avail: NTIS

Two coldfingers differentially cryopump the heavy ion source of the SuperHilac 3-MV injector. One coldfinger near the source freezes most of the source gas load and provides adequate clean vacuum for source operation. The second coldfinger near the beam entrance into the high voltage column produces high vacuum to reduce ion beam loss through charge exchange and accidental electrical discharges. The 20 K temperature is produced by a small refrigerator in the terminal, and is transmitted to the coldfingers by hydrogen-charged heat pipes. The effective system pumping speed for air at the source measures 180 l/s. While running beams of argon ions, pressures are 8 x 0.00001 at the source and 5 x 0.000001 mm Hg at the column entrance. The integral of pressure with distance along the terminal beam path is 1.8 x 1.001 mm Hg-cm. Author (NSA)

N71-32121# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
NONROTATIONAL STATES OF ODD-N DEFORMED NUCLEI IN THE REGION 153 < OR = TO A < OR = TO 171
L. A. Malov, V. G. Soloviev, and S. I. Fedotov 1971 17 p refs Submitted for publication
(JINR-E4-5567) Avail: AEC Depository Libraries

The ground and excited states of odd-N nuclei in the region 153 < or = to A < or = to 171 were calculated in the framework of the superfluid nuclear model. The calculations were performed with the Saxon-Woods single particle energies and wave functions. A satisfactory agreement of the experimental and theoretical data was obtained. Author (NSA)

N71-32123# Kernforschungszentrum, Karlsruhe (West Germany).
INVESTIGATION OF THE alpha DECAY OF ISOTOPES OF ELEMENT 105 [UNTERSUCHUNG DES alpha-ZERFALLS VON ISOTOPEN DES ELEMENTS 105]
V. A. Druin et al [1970] 11 p refs Transl. into GERMAN of Russian report JINR-P7-5161 In GERMAN
(KFK-tr-350; JINR-P7-5161) Avail: AEC Depository Libraries

The alpha decay of element 105, produced by the irradiation of Am-243 with Ne-22 ions at 120 MeV, was investigated. A long lived and a short lived activity were observed. The long lived activity was attributed to element 103, but the short lived activity with an alpha decay energy of 9.10 MeV was attributed to element 105. The effective cross section for the nuclear reaction leading to its synthesis was evaluated as nearly equal to 2 x 10 to the 33rd power/sq cm. The isotope of element 105 emitting the 9.1 MeV activity could not be ascertained. NSA

N71-32124# Iowa Univ., Iowa City. Dept. of Chemistry.
INFRARED SPECTRA OF UO AND UO2 VAPOR CONDENSED IN RARE GAS MATRICES
H. J. Leary, Jr., E. D. Cater, H. B. Friedrich, and T. A. Rooney 10 Mar. 1971 26 p refs
(Contract AT(11-1)-1187)
(COO-1182-34) Avail: NTIS

The molecules UO and UO2 were vaporized from tantalum and tungsten Knudsen cells containing variously a urania-uranium mixture, solid urania of natural isotopic composition, and solid urania, 60% enriched in O-18, in the range 2300 to 2500 K. The molecules were trapped in argon and krypton matrices at 20 K and studied spectroscopically from 4000 to 100 cm. Positively identified vibrational frequencies in argon matrices are 773 cm for UO-16, 734 cm for UO-18 and the frequencies 869, 853, and 825 cm for one of the stretching modes of the UO2 molecule of respective isotopic composition U(O-16)2, U(O-16)(O-18), and U(O-18)2. The second stretching frequency and the bending frequency of UO2 were not observed. Author (NSA)

N71-32126# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
SPIN INTERACTIONS BETWEEN SLOW ELECTRONS AND AMINO ACID FILMS Progress Report, 1 Jun 1968-28 Feb. 1971
Edward Yeargers 1 Mar. 1971 67 p refs
(Contract AT(40-1)-3799)
(ORO-3799-7) Avail: NTIS

The possibility of spin exchange between incident electrons and orbital electrons of evaporated films of aromatic amino acids is being investigated. The theoretical work was concerned with two problems: calculations of the energy levels, transition moments, and charge densities of the aromatic amino acids and the quantum mechanics of incident electron-orbital electron spin interactions. The experimental work, as proposed, was performed by irradiating amino acid films at 100 K and at pressures below 10 to the minus 7th power mm with electron beams of selected energies between 40 and 1000 eV. The light emitted as the result of such irradiation was analyzed according to wavelength and radiative lifetimes, these latter characteristics being indicative of the identity of the originating excited state. The results showed that electrons with these energies generated short-lived (singlet), long-lived (triplet), and other long-wavelength states (with lifetimes of about 50 msec.), the latter being characteristic of emission due to excitation by ionizing radiation. Author (NSA)

N71-32128# California Univ., Berkeley. Lawrence Radiation Lab.
BEVATRON EXTERNAL PROTON BEAM FACILITIES
T. Elioff, K. H. Lou, and R. C. Seh Feb. 1971 4 p refs Presented at Natl. Particle Accelerator Conf., Chicago, 1 Mar. 1971
(Contract W-7405-eng-48)
(UCRL-20194; CONF-710308-6) Avail: NTIS

A septum magnet beam splitting system has been successfully operated at the Bevatron. This system has made possible a more flexible placement of secondary particle beams and the simultaneous sharing of the external proton beam between two end stations. A second beam splitting system is under construction, and simultaneous beam sharing among three end stations will soon be possible. Other developments which will greatly increase the total flux of the external proton beam are also discussed. Author (NSA)

N71-32131# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
APOCHROMATIC METHOD FOR MEASUREMENT OF THE

MEAN PROTON ENERGY IN 667 MeV BEAM USING THE VAVILOV–CHERENKOV RADIATION

V. P. Zrelov, P. Pavlovic, and P. Sulek 1971 28 p refs In RUSSIAN

(JINR-P3-5637) Avail: AEC Depositories Libraries

A new method of measurement of the mean proton energy over the Vavilov–Cherenkov radiation by using an apochromatic doublet of prisms to compensate the radiator disperson is described. The results of testing this method on the 667 MeV proton beam extracted from the synchrocyclotron of the Nuclear Problem Laboratory are presented. The accuracy of determining the mean energy is + or − 0.03% which exceeds the accuracy of the best previously known methods by three times. Author (NSA)

N71-32134# Oak Ridge National Lab., Tenn.

SIMULTANEOUS DETERMINATION OF FAST-NEUTRON SPECTRA BY TIME-OF-FLIGHT AND PULSE HEIGHT UNFOLDING TECHNIQUES

E. A. Straker, C. E. Burgart, T. A. Love, and R. M. Freestone, Jr. 5 Apr. 1971 19 p refs Submitted for publication Sponsored by AEC

(AD-723181; ORNL-TM-3371) Avail: NTIS CSCL 20/8

Proton-recoil spectrometers have frequently been used in the past few years to measure spectra for neutron energies greater than approximately 1 MeV with the results depending strongly on the adequacy of the response matrix used in unfolding pulse-height spectra. By simultaneously measuring a fast-neutron spectrum by time-of-flight and by pulse-height unfolding, the adequacy of the response matrix and unfolding code could be determined. Spectra of several shapes and measurements with different time-of-flight resolution were used to validate the spectra obtained by unfolding the pulse-height spectrum. Author (GRA)

N71-32142# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).

FLUORESCENCE EXCITATION OF ULTRA-SOFT X-RAY EMISSION USING SYNCHROTRON RADIATION

K. Feser (Ludwig-Maximilians-Univ.), J. Mueller (Ludwig-Maximilians-Univ.), G. Wiech (Ludwig-Maximilians-Univ.), and A. Faessler (Ludwig-Maximilians-Univ.) Nov. 1970 11 p refs

(DESY-70/59) Avail: AEC Depository Libraries

Attempts were made to use the synchrotron radiation of a 7.5 GeV electron synchrotron for the fluorescence excitation of ultrasoft X-ray emission spectra. The very intense background produced by the scattered radiation of short wavelengths could be reduced so that it was possible to observe the K-emission bands of carbon (45 A), boron (67 A), and beryllium (114 A). The results are compared with data obtained by electron excitation. Author (NSA)

N71-32146# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Material- und Festkoerperforschung.

FISSION PRODUCT YIELD IN THE FISSION OF U 235, U 238, Pu 239, AND Pu 241 WITH NEUTRONS OF DIFFERENT ENERGIES [SPALTPRODUKTAUSBEUTEN BEI DER SPALTUNG VON U 235, U 238, Pu 239 UND Pu 241 MIT NEUTRONEN VERSCHIEDENER ENERGIEN]

P. Hofmann 12 Nov. 1970 155 p refs In GERMAN; ENGLISH summary

(KF-18723) Avail: AEC Depository Libraries

The stable and long lived fission products of the isobaric fission product decay series were determined which are formed during fission of U-235, Pu-239, and Pu-241 by thermal neutrons (0.025 eV) and U-235, U-238, and Pu-239 by fast neutrons (1 MeV, 14 MeV, fission spectrum). In determining the fission product yields, negative beta-decays and splitting of isobaric decay chains by emission of delayed neutrons were taken into account. The In,gamma)-reactions of the fission products which are the transition of one isobaric decay series to another were considered only in the fission of U-235, U-238, and Pu-239 by fast neutrons (fission spectrum). These fission product yields were compared with those obtained in the absence of (n,gamma)-reactions. The comparison reveals that during the fission of Pu-239 the fission yields of the lanthanides, zirconium, yttrium, and molybdenum are higher when neutron capture reactions of fission products are taken into account. Author (NSA)

N71-32163# Brookhaven National Lab., Upton, N.Y.

A CONTRIBUTION TO THE STUDY OF THE INTERACTION OF FAST NEUTRONS WITH 1p, 2s, AND 1d NUCLEI

Jacques Roturier Oct. 1970 67 p refs Transl. into ENGLISH from Ann. Phys. (Paris), v. 4, no. 3, 1969 p 289–326

(BNL-tr-380) Avail: AEC Depository Libraries

Elastic scattering of neutrons by beryllium, aluminum, silicon, potassium, and calcium is analyzed; and the experimental results are compared with predictions based on a nonlocal optical model. Very good agreement is obtained for the Al-27(n,n)Al-27 and Si-28(n,n)S-28 reactions. In the case of the Be-9(n,n)Be-9 reaction, however, it is necessary to improve the agreement with the experimental results by invoking the contribution of an isotropic term whose origin involves either disintegration of the compound nucleus or formation of a "doorway" state. For the K-39(n,n)K-39 and Ca-40(n,n)Ca-40 reactions, although the agreement is not particularly satisfactory results of other elastic-scattering studies with various incident particles are confirmed. It appears, however, that the optical model cannot be applied to these nuclei without taking their structure into account. NSA

N71-32168# California Univ., Livermore. Lawrence Radiation Lab.

LRL (LIVERMORE) 100-MeV LINEAR ELECTRON ACCELERATOR AND FACILITY

S. C. Fultz, C. L. Whitten, and W. J. Gallagher (Applied Radiation Corp.) 2 Mar. 1971 8 p refs Presented at the Natl. Particle Accelerator Conf., Chicago, 1–3 Mar. 1971 Sponsored by AEC

(UCRL-73075; Conf-710308-1) Avail: NTIS

The 100 MeV electron accelerator and facility at Livermore have been designed for undertaking investigations in neutron physics and nuclear photoreactions. This has required versatility in the performance of the accelerator and in the layout of the beam transport system. The accelerator is a 5-section S-band device with beam pulse capability of 5ns, 10A at 1800 pps to 3 microseconds 650 ma at 300 pps. A tungsten converter after the third section produces a positron beam capable of acceleration to 80 MeV. The accelerator can operate in the transient or steady state modes. The magnets used to steer the high current pulses are achromatic and can pass a momentum spread of + or − 15%. Other beam lines are achromatic and can pass a momentum spread of + or − 5%. NSA

N71-32166# Princeton Univ., N.J. Joseph Henry Labs.

PHENOMENOLOGY OF WEAK INTERACTIONS

S. B. Treiman Apr. 1971 23 p refs Presented at Conf. on the Phenomenology of Part. Phys., Pasadena, Calif., 25 Mar. 1971

(Contract AT(30-1)-4159)

(PURC-4159-22; Conf-710309-1) Avail: NTIS

A review is given of some recent developments in weak interaction physics. Some topics discussed are CP violation, second class currents, and inelastic neutrino reactions. NSA

N71-32178# Eidenoessiches Institut fuer Reaktorforschung, Wurenlingen (Switzerland).

INTEGRAL EQUATION OF TRANSPORT IN ONE DIMENSIONAL CYLINDRICAL GEOMETRY: POLYNOMIAL APPROXIMATION AND LINEAR ANISOTROPIC DIFFUSION. 1: THEORY [EQUATION INTEGRALE DE TRANSPORT EN GEOMETRIE CYLINDRIQUE A UNE

DIMENSION. APPROXIMATION POLYNOMIALE ET DIFFUSION ANISOTROPE LINEAIRE. 1: THEORIE
J. Ligou Dec. 1970 54 p refs In FRENCH
(EIR-188) Avail: AEC Depository Libraries

It is shown how, in the framework of a one-dimensional cylindrical geometry, it is possible to suppress for the most part the first insufficiency (hypothesis of uniform emission) and how to incorporate the linear anisotropy of the diffusion (P1 matrices) without supplementary complexity. After a review of the general equations, the essential ideas concerning the choice of the polynomial retained and the generalization of the resulting collision probabilities are presented. The quantities which generalize the collision probabilities and which constitute the greater part of the calculations are evaluated. Author (NSA)

N71-32179# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
TENSORIAL FORMULATION AND GEOMETRIC INTERPRETATION OF A MULTILEVEL MULTICHANNEL FORMULA FOR NUCLEAR RESONANCES [FORMA TENSORIALE E INTERPRETAZIONE GEOMETRICA DELLA FORMULA A MOLTI LIVELLI E MOLTI CANALI PER LE RISONANZE NUCLEARI]
M. Motta 26 Aug. 1970 33 p refs In ITALIAN
(RT/FI-(70)38) Avail: AEC Depository Libraries

A tensoral formulation of a simplified multilevel multichannel formula for nuclear resonances is presented. The formulation is obtained by the representation of the cross section for a given reaction as an Hermitian form in a space referred to curvilinear axes which are directly related to the Breit–Wigner single level curves. Using conformal mapping a geometrical interpretation is given in which the cross section is obtained by reflection of points on the complex plane with respect to circles, one for each level. As an example, the two-level formula is deduced by the general formula. Author (NSA)

N71-32180# Lyon Univ. (France). Inst. de Physique Nucleaire.
DEVELOPMENT OF A TEST BENCH FOR MULTICHARGED ION SOURCES. APPLICATION TO THE STUDY OF AXIAL REFLEX SOURCES [REALISATION D'UN BANC D'ESSAIS POUR LES SOURCES D'IONS MULTICHARGES. APPLICATION A L'ETUDE DES SOURCES REFLEX AXIALES]
Marcel Bajard (Ph.D. Thesis) Jul. 1970 46 p refs In FRENCH
(LYCEN-7054) Avail: AEC Depository Libraries

A test bench for multicharged ion sources was designed and constructed. Likely modifications such as the adaptation of an emittance measuring system, or the use of a Wien filter for separating the isotope beams, were foreseen. Tests on axial extraction reflex sources led to the realization of a construction favoring the production of multicharged ions, and to the definition of the optimum source parameters. An extraction geometry giving a beam of good characteristics was developed after a series of tests. The sources were tested with nitrogen, neon and argon. The study was limited to ions with four charges, corresponded to Xi = Z/A > 0.1. This value of Xi is very much better than the minimum value envisaged in linear ion accelerator projects. The various possible improvements to the system are: the use of a pulsed arc in such a way as to produce an enhanced yield of multicharged ions and a prolonging of the source life, the use of a better designed escape field permitting higher extraction potentials, and the use of an efficient focussing system to improve detection. Author (NSA)

N71-32194# Israel Atomic Energy Commission, Beersheba. Nuclear Research Center-Negev.
THE MEASUREMENT OF ENERGY LEVELS' WIDTH IN THE 6-9 MeV REGION
M. Has May 1970 46 p refs In HEBREW
(NRCN-254) Avail: AEC Depository Libraries

Energy-level widths in the region 6 to 9 MeV were measured in various nuclei using resonance scattering of nickel capture gamma rays. It was done by measuring the cross section, the self-absorbing effect, and the temperature effect. Axel's theory was used in analyzing the results. NSA

N71-32195# Ceskoslovenska Akademie Ved, Rez. Ustav Jaderneho Vyzkumu.
THE ELECTROEXCITATION OF S 32 IN THE REGION OF THE DIPOLE RESONANCE
Yu. I. Bely, N. M. Kabachnik, V. G. Neudatchin, N. P. Yudin, L. Majling et al [1970] 22 p refs
(UJV-2553-F) Avail: AEC Depository Libraries

The C1 + E1 and M2 form factors for inelastic scattering of high energy electrons by S-32 in the region of the giant dipole resonance were calculated. The wave functions of excited states were obtained in terms of a microscopic particle-hole approach of the shell model taking into account the configurational splitting and coupling of the particle-hole excitations to one- and two-phonon states. This corresponds to the diagonalization of the 64 × 64 matrix for the 1(−) states and of the 85 × 85 matrix for the 2(−) states. A good fit with the experimental data of Afanasyev and coworkers for the S-32 excitation curve at different momentum transfers was obtained though the agreement of the gamma-quanta absorption cross sections and the reaction with the experiment is not satisfactory. It is emphasized that the cross sections, the photonucleon spectra, and the transverse electron scattering form factors are particularly sensitive to the configurational composition of wave functions in different regions of the S-32 excitation curve. Author (NSA)

N71-32199# Louvain Univ. (Belgium).
MAGNETIC MOMENTS AND MIXING RATIOS IN THE GAMMA DECAY OF Te 125
M. Rots, R. Silverans, and R. Coussement [1970] 22 p refs
(NP-18704) Avail: AEC Depository Libraries

Angular correlations in the gamma-decay of Te-125 were investigated with a Ge(Li) and Na(Tl) detector combination. The results for the observed transitions are as follows: two pure M1 transition (172 and 209 keV); two pure E1 transitions (L(117 and 320 keV); one pure E2 transiton (379 keV); and one mixed transition (204 keV, −1.36 < delta(E2/M1) < −0.47. Two magnetic moments, (mu sub 9/2)(−) = −(0.66 + or − 0.09) nm (321 keV state) and (mu sub 5/2)(−) = +(0.79 + or − 0.30) nm (463 keV state) are determined, together with the precession angle = +0.107 + or − 0.024 rad for the 525-keV state. All these data, complemented by the results of Coulomb-excitation and (d,p)-reaction work, are useful in explaining the level structure in the Te-125 decay scheme. The experimental results are compared with the predictions of the Kisslinger–Sorensen calculations, and a striking agreement is found. Some comments are also made about the experimental conditions of the earlier measurements of the anticipated three-quasi-particle state at an excitation energy of 321 keV. Author (NSA)

N71-32202# Zentralstelle fuer Atomkernenergie Dokumentation, Frankfurt am Main (West Germany).
BIBLIOGRAPHIES IN NUCLEAR SCIENCE AND TECHNOLOGY. SECTION 13: DECONTAMINATION [BIBLIOGRAPHEN ZUR KERNFORSCHUNG UND KERNTECHNIK. SEKTION 13: DEKONTAMINATION]
Hermann Philipp and Erich Wichmann, comps. Aug. 1970 46 p refs Partly in ENGLISH, partly in GERMAN and partly in FRENCH
(AED-C-13-7) Avail: AEC Depository Libraries

A bibliography on decontamination with emphasis on the most efficient and most current methods for removal of radionuclides is presented. Six separate sections deal with the following aspects: buildings, large areas, and installations; equipment, materials

including clothing, food, and similar items; persons and animals; liquids; gases and aerosols; and miscellaneous items concerning decontamination equipment, installation, method, and cost problems.
NSA

N71-32203# Washington Univ., Seattle. Dept. of Physics.
CURRENT ALGEBRA AND ANALYTICITY: BOOTSTRAPPING THE RHO AND SIGMA WITH THE PION DECAY CONSTANT SETTING THE SCALE
Lowell S. Brown and Robert L. Goble (Minnesota Univ., Minneapolis) Jan. 1971 11 p refs Supported in part by AEC
(RLO-1388-602) Avail: NTIS

Simple one parameter forms for the S and P waves of pion scattering that obey current algebra constraints and allow for a resonance are constructed. The parameters are completely determined by solving self consistently three-subtracted forward dispersion relations in a region up to 1 GeV. Resonances for the rho and sigma are produced with the mass scale set by the pion decay constant, but the dispersion relations require the T = 2, S-wave be nonresonant.
Author (NSA)

N71-32206# California Univ., Berkeley. Lawrence Radiation Lab.
MECHANICAL FEATURES OF ELECTRON-RING COMPRESSORS
R. T. Avery, W. W. Chupp, H. P. Hernandez, J. R. Meneghetti, and W. W. Salsig Feb. 1971 3 p refs Presented at Natl. Particle Accelerator Conf., Chicago, 1 Mar. 1971
(Contract W-7405-eng-48)
(UCRL-20177; CONF-710308-4) Avail: NTIS

The technology of electron ring compressors draws more heavily on controlled thermonuclear research than on conventional accelerators. This is dictated by the rapidly rising, intense magnetic fields, the required ultrahigh vacuum, and the need for extensive diagnostics and instrumentation during the development phase. Interesting mechanical features of the Berkeley Compressor 3, Compressor 4, and Compressor 5 electron ring research apparatus are described, including ceramic chamber design, ceramic-metal and ceramic-ceramic joining techniques, cryo-pumping, vacuum bakeout practices, and novel diagnostic probes suitable for ultrahigh vacuum service.
Author (NSA)

N71-32207# California Univ., Berkeley. Lawrence Radiation Lab.
AN EXTERNAL HEAVY ION SOURCE FOR THE BERKELEY 88-INCH CYCLOTRON
D. J. Clark, J. Steyaert, A. Carneiro, D. Elo, P. Frazier et al Mar. 1971 10 p refs Presented at Natl. Particle Accelerator Conf., Chicago, 1 Mar. 1971
(Contract W-7405-eng-48)
(UCRL-20406; CONF-710308-5) Avail: NTIS

A heavy ion source of the PIG type has been installed on the axial injection line at the 88 Inch Cyclotron. It is now in the testing phase. Arc powers up to 4 kW have been run, and hydrogen and nitrogen beams have been injected and accelerated in the cyclotron.
Author (NSA)

N71-32252# Atomic Energy Commission Research Establishment, Riso (Denmark).
EXPERIMENTAL INVESTIGATIONS OF THE RELEASE OF RADIOACTIVITY UNDER ACCIDENTAL CONDITIONS IN A REACTOR CONTAINMENT BUILDING
W. M. Zak and O. Walmod-Larsen Apr. 1970 117 p refs
(RISO-205) Avail: AEC Depository Libraries

Experimental measurements of the dynamic as well as the static spread pattern of large amounts of airborne radioactivity suddenly released in the DR3-reactor shell at Riso were made by means of releases of Ar-41. A method of data treatment was worked out by which the data from the different measurement points and releases could be standardized and therefore directly compared. An evaluation of the preferred ventilation conditions and evacuation routes in the case of a sudden release of activity was made. Only one or two minutes elapse before significant increases in the activity concentrations are observed in and around the crane well. The control room, the elevator stairs and the personnel air lock are not affected until after several minutes. Recommendations on the present system are given.
Author (NSA)

N71-32253# Bhabha Atomic Research Centre, Bombay (India).
NUCLEAR METHODS IN TRACE ANALYSIS: A REVIEW
S. Gangadharan 1971 57 p refs
(BARC-529) Avail: AEC Depository Libraries

Nuclear methods of analysis, of which activation analysis forms a part, are briefly reviewed giving the basic principles of the methods and their potentialities and limitations. Several techniques, using different radiochemical methods of separation and varying degrees of instrumentation including computer-coupled automated systems, are briefly discussed. Sources of different projectiles, such as neutrons, charged particles and photons, and their uses are described. Depending on the nature of the problem encountered, the type of experiment varies from simple activation, followed by radiochemical separation prior to counting, to the measurement of prompt gammas/particles for nondestructive analysis and use of charged particles as microprobes. Some of the topics discussed include routine on-line determination of oxygen in steel, analysis of ultra-pure materials such as semiconductor-grade silicon and surface analysis and depth profiles of impurities in very pure metal surfaces. Applications to other disciplines are briefly mentioned.
Author (NSA)

N71-32260# Vrije Univ., Amsterdam (Netherlands).
LIFETIMES OF EXCITED STATES IN HEAVY NUCLEI
Hendrik Ton (Ph.D. Thesis) 1970 99 p refs
(NP-18695) Avail: AEC Depository Libraries

The research includes gamma ray transition probabilities in deformed nuclei, experimental methods and apparatus for the measurement of short lifetimes, and lifetimes of 2+ and 4+ rotational states in heavy even-even nuclei. Also discussed are lifetimes of rotational states in thorium-229 and uranium-235 and lifetimes of high spin states in platinum-194, platinum-196, mercury-198, and mercury-200.
NSA

N71-32261# United Kingdom Atomic Energy Authority, Harwell (England).
SELF-IRRADIATION DAMAGE ALPHA-PLUTONIUM
R. O. A. Hall and M. J. Mortimer Aug. 1970 13 p refs
(AERE-R-6506) Avail: AEC Depository Libraries

The change in the resistivity of high purity alpha-plutonium, due to self irradiation damage with time of holding in liquid helium, was measured. A small term, additional to the two terms previously reported, was found. A detailed analysis showed that a good fit was obtained using (rho - neutral rho) = 1.920(1 - exp(-065 × .001t)) - 0.400(1 - exp(-0.192 × 10.01t)) - 0.230(1 - exp(-0.172 ×10.001t)) mu Omega m. This analysis was also applied to earlier results on lower purity alpha-plutonium and to a Pu-1% Np alloy.
Author (NSA)

N71-32262# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
COMPARISON OF PION ELECTROPRODUCTION DATA WITH VECTOR MESON DOMINANCE PREDICTIONS
H. Fraas and D. Schildknecht Mar. 1971 18 p refs
(DESY-71/12) Avail: AEC Depository Libraries

Single pion electroproduction results are compared with predictions obtained within the vector meson dominance model. The large longitudinal contribution observed in pion electroproduction is successfully predicted from data on pion photoproduction and on production of vector mesons by pions from nucleons.
Author (NSA)

N71-32275# Argonne National Lab., Ill.
ACCURATE CROSS-SECTION MEASUREMENTS OF THE REACTIONS T(p,p)T, T(p,d)D, T(p,He T(p,He 3)N, AND T(p,p')T AT 13.600 MeV
J. Lewis Detch, Jr. Dec. 1970 123 p refs
(Contract W-7405-eng-36)
(LA-4576) Avail: NTIS

Differential cross sections were measured with absolute accuracies of about 1.0% and relative accuracies of about 0.7% using a thin-walled tritium gas target and silicon surface barrier detector telescope in conjunction with an on-line computer for mass identification and data handling. The angular scattering distributions and the proton asymmetries were measured at a proton laboratory energy of 13.600 MeV. In addition, differential cross sections for T(p,p)T were measured at energies of 16.230 and 19.480 MeV to provide supporting data for existing mass-4 studies. Related data is compared and preliminary attempts to analyze the data with an energy independent phase shift analysis program are discussed. Several sets of single channel phase shift solutions are given for maximum angular momentum L-values of three. Simultaneous two and three channel analyses were inconclusive. Author (NSA)

N71-32283# California Univ., Livermore. Lawrence Radiation Lab.
HADRON SPECTROSCOPY
Malcolm H. MacGregor 19 Feb. 1971 24 p refs Presented at the Conf. on Fundamental Interactions at High Energy, Coral Gables, Fla., 20 Jan. 1971 Submitted for publication Sponsored by AEC
(UCRL-73073; Conf-710106-6) Avail: NTIS

The available hadron data are arranged in such a way as to reveal any systematic experimental regularities. The discussion covers a comparison of hadronic and nuclear rotational bands, baryon and hyperon rotational bands, dibaryon states, meson and kaon rotational bands, NN resonances, basic mass quanta, the mass matrix, excitation towers, and A sub 2 splitting. Geometries of spinning and spinless mass quanta, experimental evidence for a spin-1 ABC response, Kemmer branching ratios, and lifetime systematics are included. Also discussed are baryon number, predictions and clarifications, and dynamical tests of symmetries. A compilation of experimental hadron data is included. NSA

N71-32290# European Organization for Nuclear Research, Geneva (Switzerland).
SPIN FORMALISMS. LECTURES GIVEN IN THE ACADEMIC TRAINING PROGRAM OF CERN, 1969 - 1970
Suh Urk Chung 25 Mar. 1971 81 p refs
(CERN-71-8) Avail: AEC Depository Libraries

A comprehensive view of the various spin formalisms used in the study of the elementary particles is presented. Particular emphasis is given to the description of resonances decaying into two, three, or more particles and to the methods of determining the spin and parity of resonances with sequential decay modes. NSA

N71-32291# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
GLOBAL AND LOCAL STRUCTURE OF RELATIVISTIC QUANTUM SYSTEMS
S. S. Khoruzhii and V. N. Sushko 1971 78 p refs
(JINR-E2-5575) Avail: AEC Depository Libraries

On the basis of general algebraic description of quantum system with superselection rules, developed earlier by the authors, the detailed investigation is made of the global, local and asymptotic structure of such systems. Essential part of the investigation consists in the study of equivalence properties of coherent superselection sectors. It is demonstrated that the field character of a quantum system is associated with a definite asymptotic behavior in space-like directions. Author (NSA)

N71-32295*# Pittsburgh Univ., Pa. Dept. of Chemistry.
REACTIONS OF METASTABLE NITROGEN ATOMS
Chorng-Lieh Lin and Frederick Kaufman Jun. 1971 41 p refs
(Grant NGL-39-011-002)
(NASA-CR-119685; SRCC-153) Avail: NTIS CSCL 20H

The line absorption techniques was applied the kinetic study of the two metastable atomic nitrogen states N(2(2)d) and N(2(2)P) in a flowing afterglow system. The optical absorptions of the NI 1493A (2p(32)D –3s(2)P) and 1743A (2p(32)P – 3s(2)P) transitions were used for the quantitative measurement of N(2(2)D) and N(2(2)P) concentrations. Deactivation of N((2)D) and N((2)P) by the Pyrex tube wall was found to be very efficient (it occurs at nearly every collision). The second order rate constants at 300 K for the removal of N((2)D) by O2, N2O, CO2, NO, N2, Ar, and He were found. It was established that the process for the first three reactant gases results in chemical reaction rather than physical quenching. Author

N71-32326# Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Chemical Physics.
DETERMINATION OF THE PHASES OF ELECTROMAGNETIC SCATTERING AMPLITUDES FROM EXPERIMENTAL DATA
R. B. Gerber and M. Karplus [1969] 88 p refs Sponsored in part by AEC
(HUX-3780-27) Avail: NTIS

The scattering of electromagnetic waves by systems of unknown charge distribution is considered, with the aim of establishing whether the phase of the scattered radiation (relative to incident one) can be computed theoretically from experimentally obtainable data, such as the intensity and the polarization of the scattered wave. The problem is to determine the phases of the scattering amplitude tensor from these data, and it is shown that this can be done by employing the unitarity relation of classical electromagnetic scattering theory. For the purpose of testing proposed methods for phase determination, the scattering of light by very simple systems was studied. These include the free electron, the H atom, and a macroscopic sphere of constant refraction index. The results obtained are very accurate. Using extremely crude approximations, the unitarity method is also applied to a molecular system to get an order-of-magnitude estimate of the phases. NSA

N71-32333# Lund Inst. of Tech. (Sweden). Dept. of Nuclear Physics.
PROTON HOLE STATES EXCITED BY MONOENERGETIC GAMMA-QUANTA
Clas-Otto Wene Oct. 1970 24 p refs
(LUNP-7013) Avail: AEC Depository Libraries

Elements that can be procured in thin foils were irradiated with monoenergetic gamma quanta from the reaction Li-7(p,gamma)Be-8. The energies of the photoprotons from the foil were measured with silicon surface barrier detectors. The conditions under which these protons give information about proton hole states are discussed. Results from runs on a foil of natural copper are given. Author (NSA)

N71-32334# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics.
ALPHA DECAY OF THE RESONANCE STATES OF Sm 148
I. Wilhelm, Yu. P. Popov, M. Przytula, R. F. Rumi, and M. Stempinski 1970 16 p refs In RUSSIAN
(JINR-P3-5553) Avail: AEC Depository Libraries

The spectra of eleven resonance states in the reaction Sm-147(n,alpha)Nd-144 are analyzed. The spin identification of resonances is made. The questions of partial alpha-widths distribution and of the probability of emission of alpha-particles with different orbital moments are considered. The effects of the highly excited-state structure on the alpha-decay are discussed.
Author (NSA)

N71-32339# Central Lab. for Radiological Protection, Warsaw (Poland).
X AND GAMMA THERMOLUMINESCENT DOSIMETER FOR ACCIDENTAL PERSONNEL DOSIMETRY PURPOSES [AWARYJNY PAWKOMIERZTERMOLUMINESCENCYJNY DO POMIARU DAWEK INDYWIDUALNYCH PROMIENIOWANIA X I GAMMA]
A. Koczynski, T. Musialowicz, M. Wolska-Witer, and J. Wysopolski 1970 22 p refs In POLISH
(CLOR-82/D) Avail: AEC Depository Libraries

The conditions of the usefulness of CaF2:Mn were investigated for X and gamma accidental dose measurements in personnel dosimetry. Loose powder may be used in such dosimeter. The simple construction and properties of the dosimeter are given.
Author (NSA)

N71-32340# Central Lab. for Radiological Protection, Warsaw (Poland).
ORIGIN AND EVOLUTION OF THE RADIOACTIVE CLOUDS [POWSTAWANIE I ROZWOJ CHMUR RADIOAKTYWNYCH]
Ludwika Kownacka 1970 47 p refs In POLISH
(CLOR-81/D) Avail: AEC Depository Libraries

The formation and evolution of radioactive clouds from nuclear explosion are described, and the problems of formation of radioactive particles, particle size distribution, and size and shape of the clouds are discussed. The dynamics of atmospheric processes associated with radioactive clouds are examined. Detailed discussions of turbulent mixing and thermodynamic mechanisms which determine the increase and rise of the radioactive cloud in the atmosphere are presented.
Author (NSA)

N71-32354 Minnesota Univ., Minneapolis.
AN OBSERVATION OF SURFACE STATE EMISSION IN THE ENERGY DISTRIBUTION OF ELECTRONS FIELD EMITTED FROM Ge(100)
William Bruce Shepherd (Ph.D. Thesis) 1969 221 p
Avail: Univ. Microfilms Order No. 70-15813

A discussion of the use of a differential energy analyzer for field emission electron energy distribution measurements is given. Data obtained from the central (100) facet of a clean, well-characterized Ge field emission tip is presented. Comparison of the measurements with theory is made, showing that the energy distributions originate from the valence band and an overlapping band of surface states. The total number of surface states is found to be 6.3 x 10 to the 12th power states/sq cm on the clean, annealed emitter. Adsorption of contamination from the vacuum system ambient or geometric alteration of the surface is seen to cause a reduction in the number of surface states.
Dissert. Abstr.

N71-32358 New York Univ., N.Y.
A DYNAMICAL THEORY OF HELICONS AND HELICON INTERACTIONS
Paul Michael Tannenbaum (Ph.D. Thesis) 1969 181 p
Avail: Univ. Microfilms Order No. 70-16110

A many body theory of helicons and their interactions with other elementary excitations, particles, and impurities is developed in analogy to polariton theory. Canonical transformations of the Bogoliubov type are performed on a proposed Hamiltonian model to obtain the quantum helicon dispersion and the helicon creation and annihilation operators. The results for the dispersion agree with those obtained previously. Specific effects peculiar to the quantum nature of the system are also examined. When expanded to include Coulomb interactions in the random phase approximation, it is found that these interactions have no effect on the propagation of helicons only when the latter's wavevector is parallel to the applied dc magnetic field. The effects of electron-electron correlations (Fermi liquid effects) on helicons as well as on other modes in solid state plasmas are investigated using second random phase approximation, and the Raman cross sections for the scattering from various plasma modes are also derived. Finally, the problem of helicon propagation in ferromagnetic metals and in type II superconductors in the mixed state is studied.
Dissert. Abstr.

N71-32358 Toledo Univ., Ohio.
AN EXPERIMENTAL EVALUATION OF SEVERAL NEW CASCADE ANALYSES FOR DETERMINING THE SPONTANEOUS TRANSITION PROBABILITIES OF COMPLEX ATOMS
John Leslie Kohl (Ph.D. Thesis) 1969 107 p
Avail: Univ. Microfilms Order No. 70-15585

Several new methods of data analysis are presented to correct for the contributions of cascade transitions in atomic transition probability measurements. The information gained from direct measurements of the decay curves of the cascade transitions is incorporated into the analysis of the decay curve of the main transition of interest. An experimental evaluation was made of these methods and of the most commonly used existing method of accounting for cascade transitions by measuring the intensity decay curve of the 2p9 - 1S5 transition of Ne I and analyzing the data using each of the data analyses applicable to the measurement. One of the new analyses provides a value of the mean life of the 2p9 level which is considerably more accurate than that commonly used computer curve fit method. Another of the new analyses (expected to be mainly applicable for uv transitions) was evaluated using computer generated data. This method can greatly improve the accuracy of measurements of atomic transition probabilities, provided the decay curves of all significantly intense cascade transitions can be measured.
Dissert. Abstr.

N71-32368*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ION-QUADRUPOLE EFFECTS IN ION-MOLECULE COLLISIONS
John V. Dugan, Jr. and Raymond W. Palmer [1971] 14 p refs Presented at the 7th Intern. Conf. on the Phys. of Electronic and At. Collisions, Amsterdam, 25 - 30 Jul. 1971; sponsored by the Intern. Union of Pure and Appl. Phys. and the Nederlandse Natuurkundige Ver.
(NASA-TM-X-67888) Avail: NTIS CSCL 20H

Ion-quadrupole effects are investigated via numerical calculations of capture cross sections and computer plotter studies of ion trajectories in the quadrupole field. Capture cross sections are roughly equal to Langevin values for low rotational temperatures; a large fraction of multiple reflection captures are calculated corresponding to formation of ion-molecule complexes.
Author

N71-32400# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
EVALIN: A CDC 6600 FORTRAN 4 CODE TO PERFORM AN EXTENDED VARIATIONAL APPROXIMATION FOR LIGHT AND INTERMEDIATE NUCLEI
R. Y. Cusson and H. C. Lee Jan. 1971 116 p refs
(AECL-3801) Avail: AEC Depository Libraries

A computer code is described that performs an extended Hartree - Fock variational calculation for the intrinsic state of lighter nuclei having up to 82 protons and 82 neutrons. An exact treatment of the kinetic energy of the center-of-mass and the

Coulomb two-body interaction is developed. The self-consistent orbitals can mix all the basis states including the time-reversed pairs, but are restricted to having good parity. This results in an improved variational approximation which can be applied to odd nuclei. The neutron and proton wave-functions are treated separately so as to exhibit the isospin violation due to the Coulomb force. The matrix elements of the nuclear interaction must be supplied as initial data. The initial trial wavefunction is taken to be that of the Nilsson model. Most calculated quantities are found to be within 10% of their experimental values, for nuclei with 4 < or = to A < or = to 40. Author (NSA)

N71-32417# Naval Resarch Lab., Washington, D.C.
FORTRAN PROGRAMS FOR (P, GAMMA) YIELD CALCULATIONS BASED ON VAVILOV'S THEORY OF ENERGY LOSS DISTRIBUTIONS Final Report
Kenneth L. Dunning 29 Mar. 1971 85 p refs
(AD-723188; NRL-7230) Avail: NTIS CSCL 9/2

Two Fortran programs have been written to provide a method for the analysis of (p, gamma) resonance yield curves for targets that may be thick compared to resonance width but which have a total energy loss small compared to the energy of the incident particle. For the sake of definiteness, (p, gamma) reactions are discussed but the programs may be used for some other incident particles as well. The programs are designed with several kinds of usage in view; in each, calculated and experimental yield curves are to be compared. A subprogram for plotting yield curves on a Calcomp plotter facilitates this comparison. Other subprograms provide plots that are useful in insuring that suitable parameters have been chosen as input data. Among the uses envisioned are: the extraction of resonance widths and energies from experimental (p, gamma) yield data for homogeneous targets and for targets that have a layer of inert matter or matter that contributes to the yield but which is different from that of the target; the determination of the energy loss characteristics of a layer of matter on a target which produces a reaction with a sharp resonance of known properties; the determination of target thickness, e.g., for solid targets used in neutron production; the determination of the atomic composition of certain kinds of thin films; the calculation of energy loss distributions; and the calculation of the beam energy distribution after the beam has passed through a slab of matter. Author (GRA)

N71-32426# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.
SOME PECULIARITIES OF COGNITION OF MICROWORLD
Yu. M. Lomsadze and S. G. Kaliberda 1970 22 p refs
(ITF-70-62-E) Avail: AEC Depository Libraries

A preliminary attempt is made to comprehend critically, anew, the Copenhagen explication of quantum mechanics and to appreciate the contribution of the Soviet physicists to it. The gnoseological conception is also suggested, having the purpose of reflecting the specific role of the quantum measurement in the natural-science cognition of nature. Author (NSA)

N71-32427# Japan Atomic Energy Research Inst., Tokyo.
PULSED NEUTRON EXPERIMENT ON FCA I-5
Toru Hiraoka, Masafumi Nakano, and Toshio Konishi Jan. 1971 22 p refs
(JAERI-Memo-4272) Avail: AEC Depository Libraries

Pulsed neutron experiments were carried out on a bare spherical core and a series of cylindrical cores composed of only 20% enriched U metal to measure the limited range of negative reactivity where the fundamental decay is observed. The linear relation between the prompt neutron decay constant, alpha, and the reactivity measured by multiplication method was observed to hold down to −12% Delta k/k. The results of the calculations of alpha sub c and k sub eff agree well with the experimental data. The difference in alpha sub c with the core geometry could not be observed. Distortions of the prompt neutron decay were observed at large negative reactivities. They may be due to insufficient multiplication of neutrons. Author (NSA)

N71-32428# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
WIGNER ENERGY IN IRRADIATED OXIDES BeO, MgO, Al2O3, AND SiO2 [ENERGIE EMMAGASINEE DANS LES OXYDES BEO, MGO, Al2O3 ET SiO2 IRRADIES AUX NEUTRONS]
Andre Roux (Ph.D. Thesis—Lyon Univ.) Dec. 1969 24 p refs In FRENCH
(CEA-N-1171) Avail: AEC Depository Libraries

Stored energy in BeO, MgO, Al2O3 (sintered) and SiO2 (vitrous) is weak and appears at a very large range of temperatures. The measurement of this energy was performed with an immersion calorimetric apparatus up to high temperature (1200 C). The results indicate some relations between stored energy and dimensional changes (density or lattice parameters). Interpretation of the results shows that in the four oxides, most of the Wigner energy may be attributed to Frenkel defects. In MgO a theoretical computation of defect energies indicates a preponderance of the positive ion Frenkel pairs. Author (NSA)

N71-32430# Wisconsin Univ., Madison. Theoretical Chemistry Inst.
TRANSPORT PROPERTIES OF A GAS OF DIATOMIC MOLECULES, 3
C. F. Curtiss 13 Jan. 1971 14 p refs
(PB-198282) Avail: NTIS CSCL 07D

Explicit expressions, valid in the classical limit, are derived for certain sums and integrals of the cross sections which occur in the expressions for the transport coefficients of a low density gas of rotating, nonvibrating, diatomic molecules. The integration is over the angle of deflection and the sums are over the rotational quantum numbers of the molecules after the collision. The integrand is the product of the differential cross section and an arbitrary function of the angle of deflection, the inelasiticities, and the gain in the rotation energy of a molecule. Author (GRA)

N71-32443# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Experimentelle Kernphysik.
QUASIELASTIC ELECTRON-DEUTERON SCATTERING FOR FOUR PULSE TRANSFERS IN THE RANGE 0.2(GeV/c) SQUARED LESS THAN q SQUARED LESS THAN 0.85 (GeV/c) SQUARED [QUASIELASTISCHE ELEKTRON-DEUTERON STREUUNG FUER VIERERIMPULSUEBERTRAEGE IM BEREICH 30.2(GeV/c) HOCH 2 WENIGER ALS Q HOCH 2 WENIGER ALS 0.85 (GeV/c) HOCH 2]
H. Klein Sep. 1970 77 p refs In GERMAN
(NP-18725) Avail: AEC Depository Libraries

In an electron-deuteron scattering experiment the reaction e + d yields e + p + n was investigated with a coincidence device for momentum transfers in the range 0.2(GeV/c) squared < q squared < 0.85(GeV) squared. The direction and momentum of the scattered electrons were measured with a spark chamber spectrometer. The recoil protons were detected with a counter hodoscope and their scattering angles were registered. The accumulated measurement data were stored and processed on-line with a process computer. Within the measurement error of 6% the measured electron effective cross sections agree well with the values which were calculated according to a theoretical work of Durand III. The measured proton angular distributions are in good agreement with the theoretical calculations of McGee. The measurement results ratify the validity of the scaling law for the magnetic neutron factor, whereas there is no indication for the effect of final state interactions or meson exchange currents. The square of the electric neutron form factor was determined in which the usual nucleon form factors were assumed as known. Author (NSA)

N71-32463# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
DEUTERON ACCELERATION IN THE LAS-INJECTOR OF THE JINR SYNCHROCYCLOTRON
Yu. D. Beznogikh and L. P. Zinovev 1971 18 p refs In RUSSIAN
(JINR-P9-5610) Avail: AEC Depository Libraries

A brief physical substantiation of the deuteron acceleration in the second drift multiplicity in the proton linear accelerator with the grid focusing is given. Decrease of the accelerating interval length by a factor of two by means of special caps on the drift tubes and application of the combined 2-gap buncher allows one to get the accelerated deuteron beam intensity of the same order as for the proton beam. Author (NSA)

N71-32470# Johns Hopkins Univ., Baltimore, Md. Dept. of Chemistry.
NON-APPLICABILITY FOR THE Li(+)-H2 ION MOLECULE SYSTEM OF AN INDO POTENTIAL ENERGY SURFACE OR OF THE APPROXIMATE MONOPOLE-TRANSITION MOMENT LONG RANGE FORCE EXPRESSIONS
Joyce J. Kaufman and R. Predny [1971] 34 p refs
(Contract N00014-67-A-0163-0007; F44620-69-C-0110)
(AD-723217) Avail: NTIS CSCL 7/4

Approximate monopole and transition moment methods have been customarily used for calculating long-range intermolecular forces in biological systems. These long-range forces are a major factor in governing the interaction of rare gases with physiological substrates. To test the reliability of of these calculation methods, the customary approximations were applied to one of the simplest systems (Li(+) + H2) and the results were compared with a rigorous calculation which is possible for this case. The agreement between the intermolecular energies calculated by the two methods was not satisfactory and the approximate long-range expressions were not applicable. Comparison with accurate calculations suggest an approach to the realization of better approximations for these forces. Author (GRA)

N71-32478# Bonn Univ. (West Germany).
LECTURES ON HYPERFINE INTERACTIONS, A FIELD BETWEEN NUCLEAR PHYSICS AND SOLID STATE PHYSICS. LEUVEN, 1969
E. Bodenstedt 1971 363 p refs
(NP-18702) Avail: AEC Depository Libraries

Twenty-three lectures are presented, giving a definition of hyperfine interactions and discussing the uses of hyperfine interactions in research fields. Some of these uses are: Moessbauer effect, perturbed angular correlation, NMR, magnetic hyperfine fields, Coulomb recoil implantation, rotational states, electric quadrupole moments and interactions, electric monopoles, and relaxation. The final lecture lists the kind of problems that can be investigated with hyperfine interactions. Two appendices discuss the weight of photons and its detection by Moessbauer effect, and the symmetry properties of nature and the violation of parity in weak interactions. NSA

N71-32480# Brookhaven National Lab., Upton, N.Y.
BNL SUMMER STUDY ON AGS UTILIZATION, 1970
T. E. Toohig, ed. 1970 385 p refs Sponsored by AEC
(BNL-16000) Avail: NTIS HC$8.00/MF$0.95

Topics include beams and beam layouts, high-rsolution spectrometers, computers and instrumentation, experiments for the converted AGS, and an outlook to the future. NSA

N71-32488# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
OPTICAL ABSORPTION OF GASEOUS METHANE, ETHANE, PROPANE, AND BUTANE, AND REFLECTION OF SOLID METHANE AND ETHANE IN THE VACUUM ULTRAVIOLET
E. E. Koch and M. Skibowski Feb. 1971 11 p refs
(DESY-SR-71/1) Avail: AEC Depository Libraries

The absorption spectra of gaseous n-alkanes were investigated for photon energies from 8 to 35 eV where excitations of the sigma electrons are expected to occur. For methane and ethane, the spectra are compared to reflectance measurements on solid films. A monochromator designed for work with synchrotron radiation and a windowless absorption cell were used to resolve structure. Author

N71-32504# Notre Dame Univ., Ind. Dept. of Physics.
NUCLEAR STRUCTURE RESEARCH Annual Report, 1 Jan.–31 Dec. 1970
31 Dec. 1970 261 p refs
(Grant NSF GP-15560)
Avail: NTIS

Polarization studies, very accurate excitation energy measurements, reaction mechanism studies, spin determination by particle-gamma angular correlation, coulomb excitation studies, nuclear resonance fluorescence measurements, and some work on atomic charge states are described and summarized. Light and medium mass nuclei from lithium to manganese and rare earth nuclei were studied with the emphasis on level identification, and accurate measurements of the fundamental properties of excitation energy, spin, and parity. Reaction mechanism studies with emphasis on isobaric spin phenomena are also included. Descriptions of equipment development and operation of the model FN accelerator are given. Author

N71-32508# Syracuse Univ., N.Y.
A THEORY OF ELEMENTARY COUPLINGS, 1
Marcel Wellner Jun. 1971 65 p refs Sponsored by NSF
Avail: NTIS

Some attempts at constructing a detailed dynamical theory (compensation theory) of strong interactions are revised, extended, and systematized. Author

N71-32509# Illinois Univ., Urbana. Dept. of Physics.
INELASTIC e-p SCATTERING IN MASSIVE QUANTUM ELECTRODYNAMICS
P. M. Fishbane and J. D. Sullivan Jun. 1971 59 p refs
(Grant NSF GP-25303)
(ILL-(TH)-71-9) Avail: NTIS

The leading contributions to NuW2 are calculated in the deep inelastic region for each order of the perturbation theory for quantum electrodynamics with massive photons. Scaling is broken by l n sq Q factors which come from both transverse and longitudinal phase space integrations and which exponentiate in an eikonal-like form. The important final states are characterized by a single hard proton and multiple soft meson production. There is an intimate relationship between the elastic form factor and the inelastic structure function mu W 2. A Drell–Yan–West relation holds after a slight generalization to accommodate the logarithmic violation of scaling. Author

N71-32535# Kernforschungszentrum, Karlsruhe. (West Germany).
EMISSIONS OF He 6 THROUGH NUCLEAR FISSION BY HEAVY IONS [EMISSION VON He 6 BEI KERNSPALTUNG DURCH SCHWERE IONEN]
D. D. Pulativ and S. M. Polikanov [1971] 12 p refs Transl. into GERMAN from Russian report JINR-P7-5192 In GERMAN
(KFK-tr-352) Avail: AEC Depository Libraries

The emissions of He-6 during the fission of U-238 and Au-197 by C-12 and O-16 at energies of 82 and 137 MeV, respectively, were investigated. In order to estimate the effect connected with the beta decay of He-6, measurements were taken in three motion cycles of the collector in front of the detectors.

The existence of a short-lived activity was proved, and the yield and half-life of this activity were determined. The data obtained was discussed with respect to the mechanism for the emission of He-6. (NSA)

N71-32536# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
COREGRAF 2: ADJUSTMENT AND COMPARISON WITH EXPERIMENT [COREGRAF 2: AJUSTEMENT ET BILAN DES COMPARAISONS A L'EXPERIENCE]
Serge Charbonneau, Alain Hoffmann, Bernard Laporiche, Jean Luffin, and Francis Morier Mar. 1971 155 p refs In FRENCH
(CEA-N-1344) Avail: AEC Depository Libraries

The COREGRAF code for calculation of graphite moderated lattices was compared to experiment and, as a result, a number of adjustments were made. For fresh lattices, calculations were compared to experiments made in Marius and Cesar: buckling measurements by flux maps and progressive replacement, fine measurements of the disadvantage factor, the fast fission factor, spectral indices, leakage determination based on the values of diffusion coefficient and graphite constants, and measurement of the temperature coefficient by integral and differential methods. These comparisons led to an adjustment of the U-238 resonance integral and of the variation of the U-235 fission cross section as a function of energy. For irradiated lattices, calculations were compared to chemical and isotopic analyses of fuel irradiated in power reactors and to the reactivity measurements on the Latina reactor. Cross sections of the plutonium isotopes were also adjusted. The adjusted code has been applied to the calculation of the neutron balance of graphite gas cooled reactors and a number of specifications for use have been defined. Author (NSA)

N71-32537# Centre d Etude de l Energie Nucleaire, Brussels (Belgium).
IMPROVEMENTS IN THE USE OF THE Li-6(NEUTRON,-ALPHA)TRITON REACTION FOR IN-CORE NEUTRON SPECTRUM MEASUREMENTS
G. De Leeuw-Gierts and S. De Leeuw Dec. 1970 15 p refs
(BLG-450) Avail: AEC Depository Libraries

An improved method to exploit fully the physical characteristics of Li-6(neutron,alpha)triton reaction for neutron spectrometry is described. It was shown that by analyzing simultaneously the energies of the two emitted particles by means of a two parameter analyzer the background generated by gamma radiation or competitive reactions can be eliminated and measured, while measuring the E sub alpha + E sub triton or E sub triton spectrum. Solutions to the drawbacks of E sub t spectrometry, i.e., screening of the responses to low neutron energies by the high neutron energy tail (phenomenon common to all indirect techniques) and partial superposition of the E sub alpha distribution to the triton one, are stated and illustrated. Finally an improvement related to the use of the E sub alpha = E sub triton parameter for in-core measurements is reported. Author

N71-32538 Pennsylvania Univ., Philadelphia.
A STUDY OF THE KAON(0) YIELDS PION(+) PION(−) TIME DEPENDENCE
Derek Irving Lowenstein (Ph.D. Thesis) 1969 116 p
Avail: Univ. Microfilms Order No. 70-16181

A sample of 9731 kaon(0) yields pion(+) pion(−) decays were collected in the 0 to 10 kaon(0) sub s lifetime region using magnetostrictive wire spark chambers. The kaon(0) sub s lifetime and the CP violating parameter phase were calculated using 3725 of the decays and a least squares fitting procedure applied to the kaon(0) yields pion(+) pion(−) time distribution. Dissert. Abstr.

N71-32544 Maryland Univ., College Park.
ON THE FORMULATION OF LOCAL FIELDS DESCRIBING AN INFINITE TOWER OF PARTICLES
Wing Wu (Ph.D. Thesis) 1969 59 p
Avail: Univ. Microfilms Order No. 70-15515

A local infinite component field theory is formulated. The fields are the explicit realizations (as quantum fields) of wave functions with mass-spin relations. Although the theory is trivial in that the fields are composed of an infinite stack of free fields, it serves as a simple example of an infinite component field theory with a nondegenerate mass spectrum, in which strong locality, the PCT theorem, and the spin-statistics theorem all hold. An application is made to Van Hove's model of Regge poles. It is shown that the locality requirement invalidates the reggerization in Van Hove's model. Dissert. Abstr.

N71-32559 Florida State Univ., Tallahassee.
ELECTRONIC ENERGY LEVELS OF PR(+3) AND OPTICAL ABSORPTION STUDIES OF Pr(NO3)3-6H20
David Allen Wensky (Ph.D. Thesis) 1969 248 p
Avail: Univ. Microfilms Order No. 70-16355

The electronic energy levels of Pr(+5) in Pr(NO3)3-6H20 are reported as determined from optical absorption experiments on single crystal at 77 K. With the exception of three bands, all of the electronic intra-f(n) transitions from the ground state multiplet to higher multiplet were observed. The absorption spectrum is reported along with the determined Stark level schemes of the multiplets and their respective centers of gravity. In addition to the optical work, ESR and X-ray studies of Nd(NO3)3-6H2O are presented. Dissert. Abstr.

N71-32560 Yale Univ., New Haven, Conn.
REDETERMINATION OF THE FINE STRUCTURE CONSTANT BY MICROWAVE TRANSITIONS IN H, n = 2
Theodore Vincent Vorburger (Ph.D. Thesis) 1969 108 p
Avail: Univ. Microfilms Order No. 70-16575

The delta E-S, the 2 2S1/2-2 2P3/2 splitting in H, n = 2, was remeasured. A beam of atoms is produced having a single hyperfine component of the 2 2S1/2, mj = − 1/2 metastable level. The beam then travels along the axis of a Helmholtz coil and is subjected to an electric field of microwave frequency perpendicular to this magnetic field. The RF transitions are induced at a magnetic field of approximately 400 G to the 2 2P3/2, mj = + 1/2 level at a frequency of 10840 MHz or to the 2 2P3/2, mj = −3/2 level at a frequency of 9400 MHz. Determinations of the resonant field for each hyperfine component of each fine structure transition yield four independent values of Delta E − S. The final weighted average is 9911.165 + or − .042 MHz. The recent determination of the Lamb shift S by Robiscoe is added to give a value for the fine structure splitting Delta E. This yields a value of the fine structure constant alpha(−1) = 137.0359(5). Dissert. Abstr.

N71-32562# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Teoreticheskoi i Eksperimentalnoi Fiziki.
UNIVERSAL MAGNETIC SPECTROMETER WITH 0.15 PERCENT RESOLVING POWER AT MAXIMUM PULSE OF 60 GeV/c
M. S. Ainutdinov, A. I. Alikhanov, V. M. Knyazev, V. A. Lyubimov, I. I. Pershin et al 1970 24 p refs In RUSSIAN; ENGLISH summary
(NP-18764) Avail: AEC Depository Libraries

A magnetic spectrometer is proposed to carry out the experiment at the Serpukhov proton accelerator. The spectrometer is composed of a streamer chamber 3.3 × 0.9 × 0.8 cu m in volume placed in the magnetic field of H = 17 to 20 kG; a 9 meter magnet with the width of the magnetic path equal to 0.7 m (H = 17 kG); and a wire spark chamber. The momentum resolution of the spectrometer is 0.15% for P(max) = 60 GeV/c

The aim is to study pion(−) + p interactions in the momentum interval 30 to 60 GeV/c and k(−) + p and p + p interactions in the interval 20 to 40 GeV/c with the momentum transverse squared < or = 1 GeV/c.
Author (NSA)

N71-32564# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Teoreticheskoi i Eksperimentalnoi Fiziki.

POSSIBLE QUASINUCLEAR NATURE OF HEAVY MESONIC RESONANCES

O. D. Dakarov, V. B. Mandelzweig, and I. S. Shapiro 1970 12 p refs
(NP-18774) Avail: AEC Depository Libraries

It is shown that nucleon−antinucleon potential interaction gives rise to a number of nuclear-like nonrelativistic bound states appearing as heavy mesonic resonances (with masses close to the double nucleon mass).
Author (NSA)

N71-32568# WADCO Corp., Richland, Wash. Engineering Development Lab.

GROUP CONSTANTS FOR FAST REACTOR CALCULATIONS

R. B. Kidman and R. E. Schenter Mar. 1971 239 p refs
(Contract AT(45-1)-2170)
(HEDL-TME-71-36; ENDF-143) Avail: NTIS

A current 29-group fast reactor cross section library consisting of 34 different isotopes is presented. The multigroup constants were generated by ETOX (a code which calculates group constants for nuclear reactor calculations) using the evaluated nuclear data file, ENDF/B version 2 for the fundamental nuclear data input. The library is also used to make some representative calculations on several critical assemblies.
NSA

N71-32598# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions.

NEW ISOTOPES OF IRIDIUM

E. Nadzharkov, B. Bochev, Ts. Venkova, Z. Shcheglovski, T. Kutsarova et al 1971 23 p refs In RUSSIAN
(JINR-P6-5617) Avail: AEC Depository Libraries

In compound-nucleus reactions resulting in neutron evaporation, far neutron-deficient iridium isotopes were produced by bombarding Ho with Ne-22 and Ne-20 heavy ions. The isotopes were identified according to the genetic relations with the daughter isotopes of Os and Re. New isotopes of Ir-181 (10 + or − 2 min), Ir-180 (6.5 + or − 1.5 min), and Ir-179 (4 + or − 1 min) are reported.
Author (NSA)

N71-32599 Colorado Univ., Denver.

STRANGE PARTICLE PRODUCTION IN 7.3 GeV/c NEGATIVE KAON INTERACTIONS IN DEUTERIUM

Age Jostein Eide (Ph.D. Thesis) 1969 243 p
Avail: Univ. Microfilms Order No. 70-16479

Three prong events with one or more neutral decays associated, have been studied in 50,000 pictures taken at the Brookhaven National Laboratory 80 inch bubble chamber, filled with deuterium and exposed to an incoming negative kaon beam of 7.3 GeV/c momentum. Partial cross sections were measured and resonance production was studied. The cross section for production of one neutral hyperon of strangeness -1 or of one neutral kaon is (1.59 + or − 0.03) mb. Total cross section is (37.4 + or − 1.5) mb.
Dissert. Abstr.

N71-32627# Comision Nacional de Energia Atomica, Buenos Aires (Argentina).

FABRICATION OF SEMICONDUCTOR DETECTORS OF SI(LI) FOR NUCLEAR REACTIONS [FABRICACION DE DETECTORES SEMICONDUCTORES DE SI(LI) PARA REACCIONES NUCLEARES]

H. J. Erramuspe 1970 31 p refs In SPANISH
(CNEA-287) Avail: AEC Depository Libraries

A method is presented for the manufacture of Si(Li) semiconductor detectors using a new techniques for control of depth of the total compensation zone and for automatic control for the drift process. Some characteristics of the detectors are given.
Author (NSA)

N71-32628# Lund Inst. of Tech. (Sweden). Dept. of Nuclear Physics.

HIGH ENERGY (GAMMA,xn) REACTIONS IN AU-197

K. Lindgren and G. G. Jonsson Jan. 1971 43 p refs Prepared Jointly with Lund Univ.
(LUNP-7103) Avail: AEC Depository Libraries

The bremsstrahlung-induced yields of some (gamma,xn) reactions, 1 < or = x < or = 15, in gold have been measured in the energy region 75-900 MeV. The mean cross sections in the energy region 300-900 MeV were determined. The number of valence neutrons available in the (gamma,n) reaction was estimated. The experimental cross sections of the more complex reactions are compared with cascade−evaporation calculations based upon the free-nucleon photo-pion cross sections. Fission competition must be taken into account to explain the experimental cross sections. From comparison between experimental and calculated cross sections it is found that fission is most probable at low excitation energy after the emission of several neutrons. Fission fragments were observed in a catcher foil experiment and the relative yields were determined. For two reactions the isomeric yield ratios were determined.
Author (NSA)

N71-32633# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).

ELECTROPRODUCTION OF SINGLE POSITIVE PIONS ON HYDROGEN

C. Driver, K. Heinloth, K. Hoehne, G. Hofmann, P. Karow et al Feb. 1971 49 p refs
(DESY/71-9) Avail: AEC Depository Libraries

The electroproduction of single pions(+) on hydrogen, e + p yields e' + pion(+) + n, was investigated by measuring coincidences between the scattered electron and the produced pion. The differential cross sections as functions of s(0), q(2), t and phi sub pi q were determined.
Author (NSA)

N71-32634# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).

ELASTIC ELECTRON-DEUTERON SCATTERING AND THE ELECTRIC NEUTRON FORM FACTOR AT FOUR MOMENTUM TRANSFERS: 5/(FERMI SQUARED) < q SQUARED < 14/(FERMI SQUARED)

S. Galster, H. Klein, J. Blecknenn, J. Moritz, K. H. Schmidt et al Feb. 1971 38 p
(DESY-71/7) Avail: AEC Depository Libraries

The cross section for elastic electron−deuteron scattering was measured for ten four-momentum transfers squared in the range 5 f(−2) < q(2) < 14 f(−2). From the measured cross sections the sum A(q sq) of charge and quadrupole form factors was determined. The experimental values are compared with theoretical predictions including relativistic corrections. Different deuteron wave functions and different parametrizations for the electric neutron form factor G sub EN were used. The best fit to the experimental data was found with the wave function of Feshbach-Lomon and the parametrization G sub EN(q sq) = −(mu sub N tau/1+5.6 tau) G sub EP(q sq), tau = (q sq/4M sq).
Author (NSA)

N71-32635# Wisconsin Univ., Madison. Theoretical Chemistry Inst.

THE DETERMINATION OF MODELS FOR COLLISION INDUCED POLARIZABILITY BY THE METHOD OF MOMENTS

Howard B. Levine and George Birnbaum (North Am. Rockwell Corp.) 28 Dec. 1970 17 p refs
(PB-198281) Avail: NTIS CSCL 07D

The form of the function giving the variation of the induced anisotropic polarizability with interatomic separation in a pair of interacting atoms is obtained by the method of moments. The spectrum of depolarized light in gaseous Ar, Kr, and Xe and the second Kerr virial coefficient of Ar, used to convert relative to absolute scattered light intensities, are used in this analysis. These results demonstrate that short range interactions have an important effect on the induced anisotropy. Author

N71-32637# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).

ELECTROPRODUCTION OF OMEGA-MESONS AS A TEST OF THE RHO-MESON OMEGA-MESON PION VERTEX

H. Fraas (Wuerzburg Univ.) Mar. 1971 24 p refs
(DESY-71/11) Avail: AEC Depository Libraries

A simple model for electroproduction of omega-mesons is presented. The nondiffractive part is described by elementary OPE without corrections, combined with vector-meson dominance. For the diffractive production-amplitudes helicity conservation in the direct channel is assumed. The differential cross section and the spin-density matrix of the omega-mesons are discussed particularly emphasizing the dependence on the mass of the virtual photon and the possibility to test the mass-dependence of the rho-meson omega-meson pion coupling constant. Author (NSA)

N71-32638# Cornell Univ., Ithaca, N.Y. Materials Science Center.

PARAELECTRIC RESONANCE IN KCl:Li(+)

Robert Albert Herandeen (Ph.D. Thesis) Jun. 1970 122 p refs
Sponsored by AEC
(NYO-2150-59; MSC-1323) Avail: NTIS

Paraelectric resonance spectra for KCl: Li-7(+) and KCl: Li-6(+) are presented and analyzed for three different frequencies: 63, 24, and 9 GHz. Quantitative results for the case of static electric field (E sub 0) is parallel to (001) support the <111> off-center tunneling model of Gomez, Bowen, and Krumhansl. Values for the dipole moment (mu) and zero-field splitting, (delta): mu(7) = mu(6) = 5.60.2 Debye, delta (7) = 0.77 0.03 cm, delta (6) = 1.07 0.04 cm, were obtained. These agree with results from several other experimental techniques. Detailed analysis of lineshapes and intensities indicates the presence of large random internal strains and of random electric fields. The strains are on the order of those expected from dislocations, but a satisfactory explanation for the electric fields is still lacking. The 65 GHz spectrum for (E sub 0) is parallel to (001) lends qualitative support to the model; this spectrum shows a negative resonance, or hole, similar to a feature seen previously in ESR experiments on MgO:Ni(2+) and MgO:Fe(2+). The model is shown to satisfy requirements for the occurrence of this negative resonance. Author (NSA)

N71-32644# Georgetown Univ., Washington, D.C.

MULTIPARTICLE BREAKUP KINEMATICS

J. M. Lambert Nov. 1970 42 p refs
(Grant NSF GP-23233)
(TR-1) Avail: NTIS

The kinematics of a system of particles breaking up into two, three, or four particles, as occurring in low energy nuclear physics multiparticle breakup reactions, is discussed under the assumption of sequentiality. A method of easily visualizing the kinematics of the process and calculating the energy-angle relationships of the outgoing particles, is presented. Relativistic corrections are discussed and estimated. Author

N71-32655 Auburn Univ., Ala.

AN INVESTIGATION OF ELECTRON-ELECTRON INTERACTIONS IN PALLADIUM, PALLADIUM-PLATINUM ALLOYS, AND ALKALI METALS USING NUCLEAR MAGNETIC RESONANCE METHODS

Harry Talmadge Weaver (Ph.D. Thesis) 1969 195 p
Avail: Univ. Microfilms Order No. 70-17433

The results an experimental nuclear magnetic resonance study of electron-electron interactions in metals are presented. Transient techniques were used to determine frequency-to-field ratios and spin-lattice relaxation times (T sub 1) for K-39, Rb-85, Rb-87, Cs-133, Pd-105 in the respective elemental metals and for Pt-195 in a series of palladium-platinum alloys. These experiments were carried out in the temperature range 1.2 to 4.0 K, with additional determinations of T sub 1 for palladium and cesium at 27 K and for cesium at 77 K. Measurements on the alloy system also included the resonance line widths and the spin-spin relaxation times. Dissert. Abstr.

N71-32659# Georgetown Univ., Washington, D.C. Dept. of Physics.

NUCLEAR STRUCTURE AND INTERACTION STUDIES WITH LOW ENERGY POSITIVE-ION ACCELERATORS Progress report

J. M. Lambert and P. A. Treado Nov. 1970 16 p refs
(Grant NSF GP-12227)
(NSF-GP-12227-2; TR-2) Avail: NTIS

Two Van de Graaff positive ion accelerators, with expernally switchable gas bottles to accelerate p, d, and h beams were used for investigations of multiparticle breakup reactions of low Z nuclei. Initial multiparticle breakup reaction studies were concerned with identification of the time ordering of the breakup particles, i.e., simultaneous, sequential, or a combination, investigation of the interference effects, and studies of He-5, Li-5, and Li-6 sequential states. Several reactions leading to Be-8 final states which breakup to two alpha particles were studied in an attempt to determine the time ordering as a function of the bombarding patricle's energy. Author

N71-32667 Connecticut Univ., Storrs.

FAST ELECTRON-SCATTERED ION COINCIDENCE STUDIES OF THE ARGON ION-ATOM COLLISION

George Michael Thomson (Ph.D. Thesis) 1970 83 p
Avail: Univ. Microfilms Order No. 15557

A test of the hypothesis explaining a triple valued inelastic energy loss structure for violent argon ion-atom collisions is reported. Coincidence techniques were used to obtain the fast electron energy spectrum emitted by the ions colliding with a known scattering angle incident ion energy and final scattered charge state. The reactions studied were of the type: Ar(+) + Ar yields Ar(+m) + Ar(+n) + (m+n-1)e(-). Final scattered charge states from m = 1 to m = 4 were available. Fast electron spectra in the energy range 100 ev to 250 ev were obtained from those collisions. The inelastic energy loss excitation probability and the fast electron production probability are compared as a function of the distance of closest approach. It was found that the peak of the distribution of electron energies depended upon the charge state of the ion from which the electron was emitted. Finally, the number of fast electrons emitted exhibited a dependence upon final ion charge state. Dissert. Abstr.

N71-32672# Tokyo Univ. of Education (Japan). Dept. of Physics.

BJORKEN LIMIT IN EXCLUSIVE ELECTRON PROTON SCATTERING AND HOW TO CONSTRUCT THE SCALING BEHAVIOR

Masakatsu Kenmoku 1971 21 p refs
(TUEP-71-22) Avail: NTIS

The exclusive electron proton scatterings are studied by using the operator product expansion. The behavior of the structure functions of this reaction in the Bjorken limit is determined by the difference of the dynamical dimension from the cannonical one of the source currents of the produced particles. It also becomes clear that what contributes to the scaling behavior in this exclusive reaction is the backward scattering with large angle and with few multiplicities. Author

N71-32673# Battelle-Northwest, Richland, Wash.
NEUTRON TRANSPORT BY A MOVING MEDIUM
G. Y. Vasiliev et al [1970] 6 p refs Transl. into ENGLISH from At. Energ. (Moscow), v. 28, 1970 p 356–357
(BNWL-TR-66) Avail: AEC Depository Libraries

The effects of a moving column of water on transport of neutrons in a beam perpendicular to the water filled tube were investigated. Experimental values of the diffusion coefficients obtained are found to compare favorably with calculations and with previously measured values. The results indicate that the neutron diffusion coefficient in water is independent of the turbulence. NSA

N71-32675# FIAT S.p.A., Turin (Italy).
WIGNER: PROGRAMME FOR THE CALCULATION OF THE MEAN THERMAL CROSS SECTIONS IN THE REACTOR CORE AND FOR THE PUNCHING OF LOAD DATA FOR CALCULATING THE EPITHERMAL CROSS SECTIONS [WIGNER: PROGRAMMA PER IL CALCOLO DELLE SEZIONI D'URTO TERMICHE MEDIE NEL NOCCIOLO DI UN REATORRE E PER LA PERFORAZIONE DEI DATI DI CARICO PER IL CALCOLO DELLE SEZIONE D'URTO EPITERMICHE]
M. Claps, M. Console, A. M. Moncassoli, and V. Paterlini Mar. 1971 7 p In ITALIAN
(EURATOM-008-61-12-PNII)
(EUR-4555-I) Avail: AEC Depository Libraries

The object of the Wigner program is to improve the methods of nuclear planning of the reactor core. It combines the most up-to-date methods of calculation in a single program so as to indicate with two consecutive machine runs the average thermal and epithermal cross sections in the core. The Wigner program embodies the Tempest program for the calculation of the thermal spectrum and punches the cards for the FORMEGA program for the evaluation of the epithermal and rapid spectrum. Use is also made of the most up-to-date techniques for the calculation of the heat damage factors and the epithermal self-screening factors. The thermal calculation is recycled in order to assess the damage factors with Wigner→Wilkins cross sections. One characteristic of the Wigner program is the extreme simplicity of the data required for the calculation. Only the geometrical data, temperatures and densities are needed. NSA

N71-32676# FIAT S.p.A., Turin (Italy). Sezione Energia Nucleare.
ANALYTICAL METHOD FOR REPRESENTING CYLINDRICAL B4C ABSORBERS IN TWO-DIMENSIONAL DIFFUSION CALCULATIONS
F. G. Rama and M. Claps Mar. 1971 38 p refs In ITALIAN
(EUR-4558) Avail: AEC Depository Libraries

Since the 1/V curve of the epithermal collision cross-sections of boron does not pose the difficulties inherent in the treatment of resonances, an analytical method has been developed for calculating the efficiency of B4C cluster rods, its validity being checked by examining critical experiments performed in the presence of B4C absorbers. Comparison of the calculated and measured value shows that the computation method described here is valid to an error of 4 to 5% for estimating the efficiency of B4C clusters. Author (NSA)

N71-32685# Illinois Univ., Urbana. Dept. of Physics.
ANALYSIS OF THE BEST POSITIVITY AND ANALYTICITY INEQUALITIES ON A GENERAL CROSSING SYMMETRIC PION(0)-PION(0) AMPLITUDE
Martin L. Griss Jun. 1971 71 p refs
(Grant NSF GP-25303)
(ILL-(TH)-71-8) Avail: NTIS

Inequalities derived from rigorous positivity and analyticity for the pion(0)-pion(0) double partial wave amplitudes are expressed in terms of Roskies' crossing symmetric parametrization. Using theorems on moment problems, the best inequalities for any value of sigma = 1 + n are discussed, and the result is expressed as an allowed region of the otherwise unrestricted parameter space. The sigma = 4 and sigma = 5 best inequalities are explicitly calculated and compared with previous experimental results. New inequalities relating the partial wave amplitudes and their derivatives are derived, and they are combined into the general analysis and compared with similar conditions. The moment approach is used to examine the nature of the inequalities resulting from an alternative method; the advantages and disadvantages to this approach are discussed. Author

N71-32707# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
ANALYSIS OF THE REACTION PION(+) PROTON YIELDS RHO(0)-MESON DELTA(++)-HYPERON AT 11.7 GeV/c INCIDENT MOMENTUM. PART 1: AN EXPERIMENTAL INVESTIGATION
R. O. Maddock, G. F. Pinter, and D. Evans Feb. 1971 35 p refs
(DESY-71/8) Avail: AEC Depository Libraries

The difficulty in determining the total and the differential cross sections of the double resonance process positive pion proton yields neutral rho meson Delta positive positive hyperon is discussed and a method of determining these is given which involves only few theoretical assumptions. The total cross section is (.32 + or − .04) mb. The joint decay angular distribution is analysed in terms of statistical tensor and density matrix elements. The data are consistent with pion exchange. Author (NSA)

N71-32708# Kernforschungsanlage, Juelich (West Germany). Institut fuer Festkoerperforschung.
INVESTIGATION OF THE DISLOCATION STRUCTURE OF A Ni SINGLE CRYSTAL WITH MAGNETIC SMALL-ANGLE SCATTERING OF NEUTRONS
Georg Durcansky Jul. 1970 76 p refs In GERMAN
(JUL-675-FF) Avail: AEC Depository Libraries

The dislocation structure of a Ni single crystal deformed under tension at room temperature up to the middle of the hardening region 2 was studied by means of the magnetic small-angle scattering of neutrons. The method of neutron photography was used for the study of the scattering intensity as a function of the direction of the scattering vector because it allows a total scattering diagram to be taken simultaneously. Perpendicular to the primary slip plane, a strong scattering intensity was observed. It was caused by coherent scattering of dislocated groups. A relatively large scattering fraction can be attributed to primary individual dislocations which scatter at 60 deg deformation. The dislocations found of the critical and conjugated slip plane scatter so that they have a line direction between 60 and 90 deg. Scattering by secondary or reaction products was also observed. The scattering intensity as a function of the contribution of the scattering vector and of the imposed magnetic field follows the regularity predicted by theory. Author (NSA)

N71-32725# Georgetown Univ., Washington, D.C.
NUCLEAR STRUCTURE AND INTERACTION STUDIES WITH LOW ENERGY POSITIVE-ION ACCELERATORS Final Report
J. M. Lambert and P. A. Treado Apr. 1971 52 p refs

(Grant NSF GP-23233)
(TR-2) Avail: NTIS

Van de Graff accelerators were used for investigating multiparticle breakup reactions to study nuclear structure and interactions. The initial breakup studies were concerned with the identification of the time ordering of the breakup particles, i.e., simultaneous, sequential, or combinations; interference effects; and sequential states of He-5, Li-5, Li-6, and Be-8. The experiments discussed include: isospin assignments of Li-6 excited states, angular correlation of reaction B-10(d,alpha)Be-8 (sub 2.9)alpha He-4; and alpha-alpha angular correlations for reaction Be-9(h,alpha)2alpha. F.O.S.

N71-32728# Georgetown Univ., Washington, D.C.
CORRELATION TRANSFORMATION PROGRAM
J. C. Sessler, J. M. Lambert, and P. A. Treado Nov. 1970 32 p ref
(Grant NSF GP-12227)
(TR-1) Avail: NTIS

A computer Program is described written to utilize an IBM 360-40 Computer for transforming correlation functions relevant to the decay of three particle final states produced in a sequential reaction. It has been used in analyzing results from the reaction B-10(d,alpha)Be-8(2.9)(alpha)He-4 at E sub d = 400 keV. It is presently being modified for use on a PDP-8L Computer having a magnetic tape transfer system and it will be used to analyze data from other reactions from which correlation function information is available. Author

N71-32727# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.
JN-METD1: A FORTRAN 4 PROGRAMME FOR SOLVING NEUTRON TRANSPORT PROBLEMS WITH ISOTROPIC SCATTERING IN BARE SPHERES AND HOMOGENEOUS SLABS BY THE j SUB N METHOD
T. Asaoka 16 Sep. 1970 90 p refs
(EUR-4601) Avail: AEC Depository Libraries; EUR F. Fr. 13.80

The mathematical solution of neutron transport problems in a bare sphere and infinite homogeneous slab according to the new analytical J sub N method, spherically symmetric scattering in the laboratory system being assumed, is summarized. Also described in detail is a Fortran-4 computer program JN-METD1 for accurately solving both the stationary and time-dependent problems. Author (NSA)

N71-32743# Cornell Univ., Ithaca, N.Y. Materials Science Center.
STUDIES OF RESONANT PHONON SCATTERING IN KCl:Li USING HEAT PULSES AND MICROWAVE PHONON GENERATION
Donald Jones Channin (Ph.D. Thesis) Jun. 1970 24 p refs
(NYO-2391-111; MSC-1311) Avail: NTIS

The interaction between acoustic phonons and tunneling states of defects in solids was studied in KCl:Li(+) by means of two techniques: phonon generation through resonant pumping of the tunneling states with microwaves, and scattering of heat pulses by the tunneling states. Both techniques provide information on the selection rules and defect-lattice coupling mechanisms. The frequency spectrum of the microwave generated phonons can also provide information on resonance fluorescence phenomena in solids. Author

N71-32750# Commissariat a l'Energie Atomique, Grenoble, (France). Centre d'Etudes Nucleaires.
STUDY OF INTERNAL FRICTION PEAKS IN MOLYBDENUM AFTER IRRADIATION WITH NEUTRONS AT 27 K [ETUDE DES PICS DE FROTTEMENT INTERIEUR DANS LE MOLYBDENE APRES IRRADIATION AUX NEUTRONS A 27 K]
R. Pichon, P. Bichon, and P. Moser 1970 24 p refs In FRENCH Presented at Conf. on Anelastic Effects due to Defects and Phase Transformations in Solids, Lausanne, Switz., 24-26 Jun. 1970
(CEA-CONF-1671; CONF-700624-3) Avail: AEC Depository Libraries

The internal friction peaks in Mo after irradiation with neutrons at 27 K were studied. The results obtained show the importance of relaxation phenomena associated with the reorientation and with the migration of interstitials to the stage 1 recovery of the resistivity. In the vicinity of stage 3 no peak can be associated with the migration of a second type interstitial. The model proposed then is a model with the interstitial migrating freely to the stage I sub E recovery of the resistivity. Although any stage of electric resistivity does not present the characteristics desired, that is a second-order reaction, this objection can be removed by supposing that the major part of the free interstitials created will fall back into their mother hole; the rest will be trapped by the impurities present in nonnegligible concentration in the metal used. Author (NSA)

N71-32777# Oak Ridge National Lab., Tenn.
THEORY OF INTERMOLECULAR NUCLEAR MAGNETIC RELAXATION OF ADSORBED MOLECULES, PART 2
D. Beckert 1971 7 p refs Transl. into ENGLISH from Ann. Phys. (Leipzig), v. 23, no. 1/2, 1969 p 98-103 Sponsored by AEC
(ORNL-tr-2458-Pt-2) Avail: NTIS

A formerly developed theory of the intermolecular NMR relaxation of molecules adsorbed on solid surfaces, based on the diffusion equation, is extended to processes with finite jumping lengths of the molecules along the surface. T1 is given as a function of the jumping time for different jumping lengths and it is shown that the shape of the T1 curve at the minimum depends strongly on the length of the jumps. In addition to this the temperature dependence of T2 as a function of the length of jumps and of the residence times of the molecules on the surface respectively is discussed. The theoretical results permit explaining the measurements of the intermolecular NMR relaxation times of benzene and methane adsorbed in silicagel. Author

N71-32778 Pennsylvania Univ., Philadelphia.
MEASUREMENT OF THE RELATIVE RATE (POSITIVE KAON SUB e2)/(POSITIVE KAON SUB mu2) AND AN UPPER LIMIT FOR THE STRUCTURE DEPENDENT RADIATION IN KAON YIELDS ELECTRON NEUTRINO GAMMA
Jabus Bridges Roberts, Jr. (Ph.D. Thesis) 1969 165 p
Avail: Univ. Microfilms Order No. 70-16203

The kaon(+) decay into 2 electron branching ratio was measured in a counter and spark chamber experiment. A 500 MeV/c unseparated kaon(+) beam produced by the collision of the external proton beam with a platinum target was brought to rest in a beryllium stopper. Kaons were identified by range and time of flight from the external target. Decay particles from the stopper at right angles to the beam passed through a momentum analyzing spectrometer. Positrons were identified by three low pressure threshold gas Cherenkov counters. A gamma ray detector identified decays accompanied by gamma rays. The kaon into 2 electron decay rate was normalized against the well known high energy part of the kaon decay into 3 electron positron spectrum. The kaon decays into 2 and 3 electrons were identified by momentum and as having the kaon(+) lifetime. A value of .000017 + (+ .000009 or - .000006) was obtained for the relative rate of (K sub e2)/(K sub mu2), to be compared with the V-A prediction of .000021, including radiative corrections. Dissert. Abstr.

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N71-31668# Columbia Univ., New York. Plasma Physics Research Lab.
MAGNETIC STRUCTURE OF SKEW IONIZING SHOCK WAVES
B. P. Leonard Jul. 1970 68 p refs
(Contract AF 49(638)-1634)
(AD-723652; HFOSR-71-1309TR; Rept-49) Avail: NTIS CSCL 20/9

Initially nonconducting gas is ionized by a thin viscous shock wave. Upstream there can be no magnetohydrodynamic interaction because of the zero conductivity, but the conducting downstream region may have a magnetic structure which interacts with the flow variables. A theoretical analysis is made in the zero-magnetic-Prandtl-number (non-viscous) limit, i.e., Ohmic dissipation is the dominant diffusion mechanism. Unlike magnetohydrodynamic shocks in a pre-ionized gas, ionizing shock waves are not necessarily plane-polarized. Thus skew shock structures can exist, in which the upstream and downstream magnetic field vectors and the shock wave normal do not all lie in a single plane. The existence of the viscous subshock at the front of the magnetic layer requires the upstream Mach number to be greater than unity. Explicit solutions are given for typical values of the governing parameters, showing how the magnetic field vector rotates about the shock wave normal as its transverse component chages in magnitude through the shock layer. Skew shocks are necessarily sub-Alfvenic downstream. Unlike the pre-ionized case, the range of trans-Alfvenic shock waves is not excluded, since these shocks can absorb Alfven waves within their structure. With strong magnetic fields it is possible to achieve very high downstream temperatures by Joule heating. Alternately, in some cases, magnetic energy can be fed into directed kinetic energy, producing an overall expansion shock. Author (GRA)

N71-31678# Avco Corp., Wilmington, Mass. Systems Div.
ADMITTANCE OF AN APERTURE ANTENNA RADIATING INTO A WARM OVERDENSE PLASMA LAYER
Ronald L. Fante 9 Apr. 1971 20 p refs
(Contract F19628-69-C-0121)
(AD-723299; AVSD-0206-71-CR; SR-7; AFCRL-71-0222) Avail: NTIS CSCL 20/9

The input impedance of an aperture radiating into a warm, overdense plasma layer is derived and studied. In the limit when the warm plasma layer is thin the author has found that the thin sheath approximation first obtained by Fante still holds, provided that in addition to the usual conditions, some additional simple constraints are satisfied. Author (GRA)

N71-31709# Naval Research Lab., Washington, D.C.
TRANSVERSE ELECTROMAGNETIC INSTABILITIES IN COLLISIONLESS PLASMAS Progress Report
R. C. Davidson, I. Haber, and D. A. Hammer May 1971 10 p refs
(AD-723814; NRL-MR-2244) Avail: NTIS CSCL 20/9

Computer simulation experiments are reported which verify the energy constants associated with the nonlinear theory of transverse electromagnetic instabilities. Author (GRA)

N71-31712# Harvard Univ., Cambridge, Mass. Cruft Lab.
ADMITTANCE OF COAXIALLY DRIVEN INFINITE MONOPOLE
Cheng C. Kao Mar. 1971 37 p refs
(Contract F19628-68-C-0030)
(AD-723650; SR-11; AFCRL-71-0165) Avail: NTIS CSCL 9/5

The apparent admittance of a coaxially driven infinite monopole is reexamined. Systematic procedures are found to derive the higher-order terms. Author (GRA)

N71-31749# Austin Research Associates, Inc., Tex.
TURBULENT HEATING OF PLASMAS BY STREAMING INSTABILITIES Interim Scientific Progress Report
William E. Drummond, James R. Thompson, and Millard L. Sloan May 1971 66 p refs
(Contract F44620-70-C-0087)
(AD-723663; ARA-45; AFOSR-71-1391TR) Avail: NTIS CSCL 20/9

During the past year, progress has been made toward the research goal of understanding the development and nature of turbulence generated from a source of free streaming energy within a collisionless plasma. The initial evolution of microturbulence, during which the electron drift energy is very efficiently converted to electron thermal energy and ion sloshing energy, is now largely understood. The authors have begun the development of a model of the late-time turbulence evolving in a driven toroidal confinement device. This turbulence involves a large amplitude ion wave and hot, trapped, current-carrying electrons. Calculations indicate that turbulent heating proceeds as long as the external field is applied, and the coherent ion sloshing energy increases to a significant fraction of the electron thermal energy. Author (GRA)

N71-31761# Michigan Univ., Ann Arbor. Dept. of Aerospace Engineering.
HYDROMAGNETIC KELVIN-HELMHOLTZ INSTABILITY IN SHEAR LAYERS OF NON-ZERO THICKNESS
R. S. B. Ong (Ph.D. Thesis) and N. F. Roderick (Ph.D. Thesis) May 1971 107 p refs
(Grant AF-AFOSR-0825-67)
(AD-723875; Rept-085810-4-T; AFOSR-71-1216TR) Avail: NTIS CSCL 4/1

The hydromagnetic Kelvin-Helmholtz instability is investigated for velocity shear layers of non-zero thickness. Two cases are studied in the low frequency hydromagnetic regime. The first case considers an infinite weakly nonhomogeneous two fluid plasma in the finite beta limit with the shear flow parallel to the equilibrium magnetic field. The second case considers a velocity shear region of finite thickness. Criteria for instability are found for both cases. The effect of the compressibility of the fluid on the instability is also discussed. Author (GRA)

N71-31924# Academy of Sciences (USSR), Moscow.
BREMSSTRAHLUNG OF RELATIVISTIC PLASMA
V. N. Tsytovich 1971 36 p refs In RUSSIAN
(NP-18758) Avail: AEC Depository Libraries

A general theory of bremsstrahlung is constructed, considering the processes of spontaneous and induced emission and the influence of emission processes on the distribution of plasma particles (quasi-linear effects). Author (NSA)

N71-31931# Illinois Univ., Urbana. Coordinated Science Lab.
SCATTERING OF MICROWAVES FROM PLASMA WAVES EXCITED IN AN ELECTRON BEAM-PLASMA INTERACTION
Lynn David Bollinger (Ph.D. Thesis) May 1971 96 p refs
(Contract DAAB07-67-C-0199)
(AD-723443; R-508; UILU-ENG-71-2211) Avail: NTIS CSCL 20/9

The process of incoherent scattering of microwaves from plasma waves is used to investigate the spatial development of the unstable longitudinal fluctuation spectrum of plasma electrons excited by an electron beam in a plasma in the absence of an external magnetic field. The most unstable plasma waves propagating

at any angle to the beam direction are found to have a phase velocity approximately equal to the projection of the beam velocity in that direction and are thus directly excited by the beam. The effect of a finite beam radius on the instability is experimentally determined, and, it is found that this effect is modified as the instability develops. Microwave scattering from the harmonic of the plasma wave is observed and the dispersion behavior of the harmonic wave measured. Experiments comparing the radiation emitted by the plasma waves to the microwaves scattered from the plasma waves are in agreement with a theory by Ichimaru and Starr. Author (GRA)

N71-31963# Academy of Sciences (USSR), Moscow.
PLASMA BREMSSTRAHLUNG FROM RELATIVISTIC PARTICLES IN A TURBULENT PLASMA
V. N. Tsytovich 1971 31 p refs In RUSSIAN
(NP-18758) Avail: AEC Depository Libraries

Two mechanisms of relativistic-particle emission in turbulent plasma are discussed: (1) induced and spontaneous emission during Compton scattering on nonresonant turbulent plasma oscillations, previously described by the author, and (2) the process of a new bremsstrahlung effect during scattering on resonant turbulent oscillations. The spectral composition and angular distribution of the radiation and the particle energy losses due to the plasma bremsstrahlung are analyzed. The influence of multipole scattering on the emission processes was studied. The intensity of the plasma bremsstrahlung shows a slight dependence on the particle mass and is, in particular, higher for the ions. The effect of turbulent expansion of the Cherenkov resonance was interpreted as resulting from the multiple scattering of particles on the resonances of plasma pulsations. Author (NSA)

N71-32135# Massachusetts Inst. of Tech., Cambridge. Fluid Mechanics Lab.
ION TEMPERATURE SENSITIVE EFFECT IN TRANSIENT LANGMUIR PROBE RESPONSE
Juan R. Sanmartin Feb. 1971 61 p refs
(Contract N00014-67-A-0204-0040; ARPA Order 322)
(AD-723529; PUB-71-5) Avail: NTIS CSCL 20/9

A theory is presented for a method, recently proposed by Hester and Sonin, of determining the ion temperature in a plasma by measuring the transient current response of a highly negative, cylindrical Langmuir probe under conditions where collection is collision-free and the ratio of probe radius to Debye length is small. The ion component of the current does not approach its final steady-state value monotonically, but exhibits a strong, ion temperature dependent overshoot in the first few ion-plasma periods following the biasing of the probe. Analytical formulae are derived for a Maxwellian plasma, and convenient graphical results are presented. The possible masking of the overshoot by a transient displacement current is discussed and found to be often negligible. For other conditions an alternative measuring method is suggested in which the contribution of the displacement current cancels out. Author (GRA)

N71-32145# Naval Research Lab., Washington, D.C.
NONLINEAR DEVELOPMENT OF THE BEAM CYCLOTRON INSTABILITY
Martin Lampe, Wallace M. Manheimer, John B. McBride, Joseph H. Orens, Ramy A. Shanny et al Apr. 1971 17 p refs
(AD-723527; NRL-MR-2238) Avail: NTIS CSCL 20/9

A theory is presented for the nonlinear evolution of the beam cyclotron instability, together with the results of a series of computer experiments confirming the main points of the theory. The authors conclude that at a turbulent level which is proportional to Omega sub CE/omega sub pe) squared, a transition is made to the nonmagnetic ion acoustic instability. For small T sub i/T sub e, the system then evolves until the fluctuating fields become strong enough to stabilize by ion trapping. Author (GRA)

N71-32150# Naval Research Lab., Washington, D.C.
ELECTROMAGNETIC AND FINITE beta SUB e EFFECTS ON THE COUNTERSTREAMING ION INSTABILITY
Carl E. Wagner, Konstantinos Papadopoulos, and Irving Haber Apr. 1971 12 p refs
(AD-723528; NRL-MR-2239) Avail: NTIS CSCL 20/9

It was found theoretically and by computer simulation that finite electron beta sub e simply enlarges the region of instability of ions counterstreaming across a magnetic field while the rest of the linear and nonlinear theory remains unchanged. Author (GRA)

N71-32200# Michigan Univ., Ann Arbor. Dept. of Aerospace Engineering.
EFFECTS OF WEAK COLLISIONS ON DRIFT WAVE INSTABILITIES
R. S. B. Ong (Ph.D. Thesis) and M. Y. Yu (Ph.D. Thesis) May 1971 60 p refs
(Grant AF-AFOSR-0825-67)
(AD-723674; Rept-085810-3-T; AFOSR-71-1215TR) Avail: NTIS CSCL 20/9

The paper is concerned with the effect of weak collisions on the stability of low frequency waves in an inhomogeneous plasma. A model collision operator of the Fokker-Planck type is used to describe interactions between charged particles. The effect of these interactions appear as velocity space diffusion and friction. An exact integral of the kinetic equation is obtained. In the limit of low collision frequencies, the effects of collisions on the ion-acoustic wave, the drift wave and the drift-cyclotron wave instabilities are considered and compared with those of the other models. The present results indicate that this model differs considerably from that of Batnager, Gross and Krook, and is a more appropriate collision model for a plasma. Author (GRA)

N71-32201# Technion - Israel Inst. of Tech., Haifa. Direct Energy Conversion Lab.
ON THE OPTICAL TRANSMISSIVITY OF GASEOUS DISCHARGES
S. Gavril Oct. 1970 19 p refs
(PB-196166; RR-70ECL6) Avail: NTIS CSCL 20I

The report is concerned with measurement of the self absorption in a helium discharge. For plasma generated in a cylindrical discharge tube, both the longitudinal and transverse distributions of the emission coefficient are of interest; these are obtainable by systematic scanning of the discharge. Author (GRA)

N71-32212*# Translation Consultants, Ltd., Arlington, Va.
THE POSSIBILITY OF USING MICROWAVE IONIZATION TO OBTAIN NONEQUILIBRIUM PLASMA IN MHD GENERATORS [O VOZMOZHNOSTI ISPOLZOVANIYA MIKROVOLNOVOY IONIZATSII DLYA POLUCHENIYA NERAVNOVESNOY PLAZMY V MGD-GENERATORAKH]
Washington NASA Aug. 1971 11 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 16, no. 5, May 1971 p 705–710
(Contract NASw-2038)
(NASA-TT-F-13783) Avail: NTIS CSCL 20I

The possibility of creating high-conductivity, nonequilibrium plasma at low gas temperature is pointed out. The plasma can be used in MHD generators. Microwave plasma conductivity in excess of 100 mohms/m can be obtained in argon without alkali metal admixtures. Estimates are given for the efficiency of use of this preliminary ionizer in MHD devices. Data obtained are compared with experimental results using electron flow as the preliminary ionizer in MHD generators. Author

N71-32233*# Translation Consultants, Ltd., Arlington, Va.
ECHO EFFECT IN RELATIVISTIC PLASMA [OB EFFEKTE EKHA V RELYATIVISTSKOY PLAZME]
V. N. Pavlenko et al Washington NASA Aug. 1971 8 p refs

Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 16, no. 5, May 1971 p 788–793
(Contract NASw-2038)
(NASA-TT-F-13785) Avail: NTIS CSCL 20I

The effects of time echo in relativistic electron plasma are considered. It is shown that repeated excitation of strong damping oscillations in the plasma can cause slight long-wave damping echo oscillations. The limiting electron speed effects the shape of the echo oscillations when relativistic effects are taken into consideration. Author

N71-32251# Purdue Univ., Lafayette, Ind. Project Squid Headquarters.
THEORY OF AN ELECTRIC CURRENT CARRYING DISCONTINUITY DRIVEN THROUGH NONCONDUCTING GAS BY A LORENZ FORCE
Roger W. Gallington and Charles E. Bond Mar. 1971 41 p refs Prepared in cooperation with Ill. Univ., Urbana and Air Force Acad., Colo.
(Contract N00014-67-A-0226-0005; Proj. Squid)
(AD-723804; SQUID-TR-ILL-21-PU) Avail: NTIS CSCL 20/9

A physical model is presented for the structure of an electric-current-carrying discontinuity moving into nonconducting gas and leaving nonconducting gas behind. The model assumes a normal shock wave followed by a porous current sheet. A three-fluid analysis (electrons, neutrals, and singly-charged ions) is made for the case where the component of magnetic field normal to the plane of the discontinuity is zero. All the dependent variables can be computed as functions of displacement in the streamwise direction, as demonstrated in two specific examples. The model admits finite-strength current sheets as solutions, with the electron and ion density diminishing to zero upstream and downstream of the sheet. As seen moving with the discontinuity, the impressed electric field and the induced electric field are additive. This is in contrast to the case for magnetohydrodynamic shock waves, where these two fields cancel on both sides; and to gas-ionizing shock waves, where the two fields cancel on the downstream side. In the frame of reference moving with the discontinuity, the discontinuity dissipates electrical energy and decelerates the gas. Author (GRA)

N71-32259# McElroy (Ralph) Co., Austin, Tex.
VELOCITIES OF PARTICLES OF A REFRACTORY MATERIAL INJECTED INTO AN ARC PLASMA JET [VITESSE DE GRAINS D'UN MATERIAV REFRACTAIRE INJECTES DANS UN CHALUMEAU A PLASMA D'ARC]
A. Lamoine et al [1971] 16 p refs Transl. into ENGLISH from Chim. Ind. (Paris), v. 102, 1969 p 1304–1311 Sponsored by AEC Prepared for Los Alamos Scientific Lab., N.Mex.
(LA-tr-71-27) Avail: NTIS

Batches of particles of nickel, carbon and alumina, with a range of diameters between 25 and 160 microns, were injected in the nozzle of a plasma jet. Using a high-speed slit-camera, the velocity of the particles (50 to 300 meters/second) at various distances from the nozzle (4 to 10 cm) were measured, and compared to theoretical values. It is shown that the velocity went through a maximum, and the position of this maximum was assessed. The movement of the particles relative to the gas occurs in an intermediate regime, the so-called Allen regime, and it is shown that the law of this movement is practically independent of temperature. The velocity of the gas on the axis at the exit of the nozzle (650 m/sec) was deduced as a function of the distance from the nozzle. Author

N71-32369 Minnesota Univ., Minneapolis.
INVESTIGATION OF THE CATAPHORESIS EFFECT IN GAS DISCHARGES
Jai Prakash Gaur (Ph.D. Thesis) 1969 137 p
Avail: Univ. Microfilms Order No. 70-15727

A theory was developed for the segregation phenomenon in gas mixtures subjected to a dc discharge. The analysis considered the production and loss processes of the ions responsible for the segregation. The starting point of the original theory of Druyvesteyn was rigorously proved. The present theory can be used to predict the axial dependence and the degree of ionization of the readily ionized constituent, provided the production rates of the ions of this component are known. Experimental measurements were also made of the ion species present in the positive column of dc discharges in helium-neon and helium-argon mixtures by sampling through a 35 micron diameter orifice in the wall of the discharge tube. Methods are described for determining three body conversion coefficients for the production of homonuclear diatomic ions. The techniques involved measurement of the currents due to atomic and molecular ions effusing from the positive column of a dc discharge. Dissert. Abstr.

N71-32383 Rutgers Univ., New Brunswick, N.J.
A STUDY OF THE EFFECT OF PRESSURE ON THE STRIATED POSITIVE COLUMN
John Wilson Weatherly, III (Ph.D. Thesis) 1970 195 p
Avail: Univ. Microfilms Order No. 70-16958

The effect of pressure on the distance between striations in the positive column of a gas discharge was investigated. The two differential equations which describe the electron energy and the field in the striated column were based on kinetic theory and involved current density, probability of electron loss, recombination coefficient, probability of ionization, mobility, electron temperature, ionization potential, and physical constants. All of these parameters could be measured or predicted except the recombination coefficient. The equations were solved by a standard Runge-Kutta technique, and the recombination coefficient was varied until the solution predicted the spacing between striations found experimentally. This was done at various pressures for argon, helium, oxygen, and nitrogen. Values of the recombination coefficient thus determined compared favorably with published data. The solution also predicted the fluctuating electron energy and field, the damping of both, and negative values of the field which had been observed experimentally. Dissert. Abstr.

N71-32388*# National Aeronautics and Space Administration, Washington, D.C.
QUASI-HYDRODYNAMIC APPROACH TO THE PROBLEM OF SUPERSONIC PLASMA FLOW NEAR A MAGNETIC DIPOLE [O KVAZIGIDRODINAMICHESKOM PODKHODE K PROBLEME SVERKHZVUKOVOGO TECHENIYA PLAZMY OKOLO MAGNITNOGO DIPOLYA]
M. V. Samokhin Jul. 1971 10 p refs Transl. into ENGLISH from Magn. Gidrodin. (USSR), no. 4, 1966 p 19–25
(NASA-TT-F-12800) Avail: NTIS CSCL 20I

The supersonic flow of rarefied plasma in the equatorial plane of a magnetic dipole is discussed. Magnetic field lines are assumed to be straight, and the field intensity is assumed to tend toward a constant value at infinity and varying inversely proportional to the distance from the axis near the origin of coordinates. The line on which the normal velocity equals the local Alfven velocity forms a shock wave trail, but the line on which the normal velocity component disappears forms the boundary of the magnetosphere which is the forbidden zone for the direct solar plasma flow. The position of the stagnation point and the shock wave front was found to be defined by the Mach number, and the shock wave asymptotes form the Mach angle with the undisturbed velocity vector. Author

N71-32393 Minnesota Univ., Minneapolis.
NOISE TEMPERATURE AS A TOOL IN GAS DISCHARGE RESEARCH
Roger Alan Messenger (Ph.D. Thesis) 1969 100 p
Avail: Univ. Microfilms Order No. 70-15776

A way to determine the mean electron energy in gas discharges is discussed. Two reliable measurements of electron energy in the form of noise temperature by: (1) using an external probe which does not disturb the plasma, and (2) measuring a quantity which exists regardless of the electron velocity distribution are presented. Basically, the method consists of two measurements--noise and resistance. First, the equivalent short circuit noise current of the discharge is measured at a frequency high enough so that low frequency noise processes no longer influence the measurement and high enough so that the external probe is adequately coupled to the plasma. Then the resistance between the probe and electrodes of the discharge tube is measured at this same frequency (usually 30-50 MHz), and the equivalent short circuit noise current of the first measurement is equated to the equivalent short circuit thermal noise current of the resistance of the second measurement. This gives the temperature to which the resistance would have to be raised for it to produce the same short circuit noise power as produced by the discharge at the measuring frequency. Dissert. Abstr.

N71-32483*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CURRENT DRAINAGE TO A HIGH VOLTAGE PROBE IN A DILUTE PLASMA

Norman T. Grier and Daniel J. McKenzie, Jr. [1971] 10 p refs Proposed for presentation at the 10th Aerospace Sci. Meeting, San Diego, Calif., 17-19 Jan. 1972; sponsored by the AIAA

(NASA-TM-X-67890) Avail: NTIS CSCL 20I

The current drainage from a plasma through apprxomately 0.05 cm diameter holes in Kapton H polymide film, FEP type C., and quartz microsheet placed on a probe at voltages up to 2000 volts d. c. have been determined both theoretically and experimentally. A Laplace field was used to numerically predict an upper limit for the drainage current. The measured current was less than the theoretical current for the FEP and quartz, and the two were approximately in agreement for Kapton H. The measured currents were on the order of 5 microamperes with the theoretical currents on the order of 10 microamperes. Author

N71-32595# Leeds Univ., (England). Dept. of Electrical and Electronic Engineering.

GASEOUS TOWNSEND DISCHARGES IN GAS MIXTURES, IN A CROSSED MAGNETIC FIELD AND IN A MOVING GAS Progress Report, 1 Oct. 1969 - 30 Sep. 1970

A. E. D. Heylen and M. P. Watt 9 Oct. 1970 32 p

(Contract F61502-68-C-0013)

(AD-723651; AFCRL-71-0110; PR-12) Avail: NTIS CSCL 20/9

The report discusses the following three topics: Maximization of sparking voltage and electrical conductivity in argon-hydrocarbon gas mixtures; Dynamic Townsend discharge in a crossed magnetic field; and, The electric strength of a moving gas. GRA

N71-32596# RCA Victor Co., Ltd., Montreal (Quebec). Research Labs.

PROPAGATION OF A STRONG CIRCULARLY POLARIZED ELECTROMAGNETIC WAVE THROUGH AFTERGLOW PLASMAS NEAR THE ELECTRON CYCLOTRON FREQUENCY

Issie P. Shkarofsky Nov. 1970 64 p refs

(Contract F19628-70-C-0093)

(AD-723293; RCA-NMLO-71-TR-002; PSP-97; AFCRL-71-011B; SR-1) Avail: NTIS CSCL 20/9

The report discusses the experimental observation of enhanced transmission of a strong right-hand circular wave near cyclotron resonance in an afterglow helium slab plasma occurring at earlier times than for a corresponding weak electromagnetic field. A strong field heats the electrons and alters the collision frequency and the velocity distribution function. For our experimental conditions, electron-electron relaxation processes can influence the distribution function. Furthermore, because of the field dependent absorption coefficient, the temperature and field strength can vary within the plasma slab. Although the collision frequency increase with temperature predicts an earlier time for stronger-field transmission at cyclotron resonance, none of the above processes is sufficient to explain the experimentally observed large spread in times of transmission for various electric field strengths. The explanation is ascribed to the fact that the electron density decay constant due to diffusion also increases with temperature, so that the electron density decay rates vary with electric field resulting in a larger spread in times of transmission. Experimental results from double probes and interferometer phase measurements also indicate a decrease in density subject to strong fields. Author (GRA)

N71-32814 Kansas State Univ., Manhattan.

THE DESIGN AND SOME EMISSION CHARACTERISTICS OF AN ECONOMICAL dc ARC PLASMA JET EMISSION SOURCE FOR SOLUTION ANALYSIS

Stephen Ernest Valente (Ph.D. Thesis) 1970 117 p

Avail: Univ. Microfilms Order No. 70-16652

Several different design modifications of plasma jets were constructed and evaluated under a variety of operating conditions using the gases Ar, He, and N2. A stable plasma jet discharge capable of operating at low inert gas flow rates was produced and was further developed for use as a spectroscopic excitation source. The final design and operation of the excitation source are presented in detail. The source operates from a conventional dc-arc power supply and uses commercially available electrodes. Total inert gas consumption is less than 2.5 liters per minute. The source can be operated continuously for several hours at a time. The emission response of the source as a function of various operating parameters was investigated. Emission characteristics of the source were then determined under selected operating conditions. Background and emission intensity distributions are presented. Dissert. Abstr.

N71-32744# Stanford Univ., Calif. Inst. for Plasma Research.

ANALYTIC INVERSION OF THE FIVE-POINT POISSON OPERATOR

O. Buneman Jan. 1971 13 p refs

(Contract AT(04-3)-799)

(SU-IPR-409) Avail: NTIS

Situations-unbound domains, potential solutions of finite difference operators, and pre-calculation of potentials on boundaries, are examined for the analytic inversion of five point Poisson operator. Also discussed is the availability of a standard ideal potential pattern for checking a program which is intended to solve the five point situation. Tables are included. E.H.W.

N71-32782# Miami Univ., Coral Gables, Fla. Optical Physics Lab.

ION AND NEUTRAL DRIFTS IN THE HOLLOW CATHODE DISCHARGE TUBE

Walter I. Fried Jan. 1971 96 p refs

(Grant AF-AFOSR-1496-68)

(AD-724160; MIAPH-OP-71-2; AFOSR-71-1507TR) Avail: NTIS CSCL 7/4

A two-channel Fabry-Perot interferometer for the measurement of very small displacements of spectral lines has been constructed. Advantage is taken both of the superior throughput and resolution of the Fabry-Perot. The two-channel operation is produced by the use of two concentric polarizers and a rotating analyzer. Application is made to the study of the alkaline earths, barium and strontium, in a helium filled Schüler hollow cathode plasma. The applicability of alkaline earth tracers to determine volume pressure force and electric field strength in the cathode glow is studied. The observed ion drifts are related to electron field strength through mobility. The

results indicate maximum of electric field strength of about 0.5 v/cm at 1 torr for both Ba and Sr, and a neutral drift toward the anode inversely proportional to pressure for Ba. Author (GRA)

N71-32800# Massachusetts Inst. of Tech., Cambridge. Fluid Mechanics Lab.

END EFFECT IN LANGMUIR PROBE RESPONSE UNDER IONOSPHERIC SATELLITE CONDITIONS

Juan R. Sanmartin Apr. 1971 48 p refs

(Contract N00014-67-A-0204-0040; ARPA Order 322)

(AD-723531; PUB-71-8) Avail: NTIS CSCL 4/1

A theory is presented for an end effect in the current response of a highly negative, cylindrical Langmuir probe in a collisionless plasma flow. Under conditions where ratio of probe radius to Debye length is small and the ion-acoustic Mach number is large, the current exhibits a strong peak when the probe axis is brought into alignment with the flow direction. Closed formulae are given for the maximum and angular half-width of the peak, and universal graphical results are presented for the entire peak structure. The theory shows very good agreement with experimental data. The use of the end effect for diagnostic purposes, in particular for the determination of the ion temperature, is discussed. Author (GRA)

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N71-31642*# Westinghouse Electric Corp., Baltimore, Md. Aerospace Div.

A 60 × 60 SOLID STATE IMAGING SYSTEM UTILIZING HYBRID LSI TECHNIQUES

W. G. Mend, E. E. McCoy, and R. A. Anders *In* Kentucky Univ. Proc. of 1970 Carnahan Conf. on Electron. Crime Countermeas. Apr. 1970 p 141-147 refs (See N71-31628 19-10)

(Contract NAS8-5112)

(NASA-CR-119765) Avail: NTIS CSCL 20L

The mechanical fabrication and electrical operation of the phototransistor sensing array system. A discussion is presented of the logic circuitry needed for the system to address and read out the phototransistor array. A discussion of the processing circuitry needed at the display terminal to provide CRT Z-axis modulation and XY deflection signals is included. The techniques employed in accomplishing large-scale integration (LSI) and associated problem areas are also discussed. Some performance characteristics of the system are also presented. Author

N71-31668# Cornell Univ., Ithaca, N.Y. Materials Science Center.

INTRINSIC FLUCTUATIONS IN THE DRIVEN JOSEPHSON OSCILLATOR

Walter H. Henkels and Watt W. Webb 28 Apr. 1971 16 p refs

(Contract N00014-67-A-0077-0016)

(AD-723235; MSC-1549; MSC-TR-2; NYO-3029-51) Avail: NTIS CSCL 20/12

Rounding of the steps induced in the current-voltage characteristic of small capacitance superconducting weak links by microwave radiation has been measured and found to confirm predictions of Stephens theory of phase fluctuations in the driven Josephson oscillator. Author (GRA)

N71-31708# New Mexico Univ., Albuquerque. Dept. of Electrical Engineering and Computer Science and Bureau of Engineering Research.

ELECTRONS IN RANDOM MEDIA

O. C. Meirelles and W. J. Byatt Apr. 1971 88 p refs

(Contract N00014-68-A-0158)

(AD-723597; EE-185(71)ONR-005) Avail: NTIS CSCL 20/12

The question of particle transport in solids is discussed, for which there are available both classical and quantum mechanical formulations. In the past, the classical formulation, especially among engineers, has led to a diffusion theory description of particles in solids. It is the contention of this work that such a description is valid only asymptotically and otherwise suffers from serious deficiencies which are discussed. Starting from the Boltzmann equation for the elastic scattering of electrons in solids, it is shown that when the scattering angles are discretized, the logical outcome is not the diffusion equation, but is, rather, a family of first order partial differential equations. This set of equations is then generalized in both one and two dimensions to include absorption and internal sources, and solutions are written down for a number of cases of some physical interest. Author (GRA)

N71-31736# Hughes Research Labs., Malibu, Calif.

CADMIUM TELLURIDE MODULATOR MATERIAL Annual Technical Report, 1 Dec. 1970 - 30 Apr. 1971

A. L. Gentile, J. E. Kiefer, and N. R. Kyle May 1971 25 p refs

(Contract N00014-70-C-0303)

(AD-723859) Avail: NTIS CSCL 20/2

The growth of single-crystal cadmium telluride by a modified Bridgman technique is being investigated to improve the material for use in infrared modulator devices. This investigation also provides evaluation criteria for use as an infrared window. A systematic variation of selected crystal growth parameters, together with quench and post-growth thermal anneal parameters, is being performed to accomplish this goal. Variation in crucible configuration, utilizing a ball-shaped tip, has shown promise for improved crystallinity of CdTe ingots; all runs using this crucible showed single crystal starts. Installation of a new furnace with increased hot zone promises greater modulator rod yield and longer lengths. Two types of defects - inclusions and random planar (111) imperfections - have been observed in some CdTe crystals. Heat treatment improves absorption properties of crystals with in-grown inclusions, but measured values of absorption coefficient of these crystals do not attain the range of 0.001 to 0.005/cm, typical of material with no initial defects. The technique used for measurement of the electro-optic coefficient is described. Author (GRA)

N71-31737# Naval Research Lab., Washington, D.C.

COMPUTER PROGRAMS FOR THE ANALYSIS OF THE BROADENING OF X-RAY POWDER PATTERNS Final Report

E. A. Metzbower 5 Apr. 1971 46 p refs

(AD-723191; NRL-7253) Avail: NTIS CSCL 20/2

The report discusses in detail computer programs that have been written to analyze the broadening of x-ray diffraction peaks of hexagonal close-packed metals. The programs allow for the correction of the overlap of the long tails of the diffraction peak, and then correct for polarization and geometric factors, atomic scattering factors, and the K alpha doublet. Fourier coefficients are calculated using Filons method of evaluating trigonometric integrals. The Stokes corrected Fourier coefficients are separated into particle size and distortion coefficients using the Warren-Averbach technique modified for hexagonal close-packed metals. Domain sizes are obtained from fault-unaffected peaks, whereas stacking fault probabilities are obtained from fault-affected peaks. Author (GRA)

N71-31738# Naval Scientific and Technical Information Centre, Orpington (England).

DIFFUSION OF IMPURITIES FROM THE GAS STREAM IN EPITAXIAL LAYERS OF GaP GROWN BY THE SENDOVITCA METHOD

L. I. Dyakonov et al Mar. 1971 9 p refs Transl. into ENGLISH

from Izv. Akad. Nauk SSSR, Neorg. Mat. (Moscow), v. 3, no. 7, 1967 p 1147–1151
(AD-723589; NSTIC-29479; NSTIC-TRANS-2037) Avail: NTIS CSCL 20/2

The task of uniformity of diffusion of impurities from a gas stream in an epitaxial layer grown by the sandwich method has been solved theoretically. The criterion derived is determined by the uniformity of diffusion. The results of the calculations coincide qualitatively with the experimentally discovered uniformity of the diffusion in a layer of phosphide of gallium of the impurities of GaAs, falling into a layer as a result of the linings corrosion. The possible causes of divergence of the experimental results from the theoretical have been considered. Author (GRA)

N71-31754# Massachusetts Inst. of Tech., Cambridge.
RESEARCH IN MATERIALS Annual Report, 1970–1971
Apr. 1971 412 p refs
(Contracts ARPA SD-90; DAHC15-67-C-0222)
(AD-723090) Avail: NTIS CSCL 20/12

The report describes the research conducted at MIT in the field of materials in the academic departments of the Schools of Science and Engineering, the Research Laboratory for Electronics, the Francis Bitter National Magnet Laboratory, the Charles Stark Draper Laboratory, and the solid State Division of the Lincoln Laboratory. The research includes the following fields: Chemical and solid state physics; Electrical, magnetic, and optical properties of materials and application to devices; Metallurgy and materials science; and Materials engineering. GRA

N71-31774# Technische Hochschule Carola Wilhelmina, Brunswick (West Germany).
SURFACE EFFECT ON THE 1/f NOISE OF GERMANIUM [OBERFLAECHENEINFLUSS AUF DAS 1/F-RAUSCHEN VON GERMANIUM]
Reinhard Lueken (Ph.D. Thesis) 1969 139 p refs In GERMAN
Avail: NTIS

Selective noise-free amplification is used to determine the surface effect of the 1/f-noise in n-p germanium semiconductor by observing the frequency dependence of the noise current. Field effect measurements in an ultrahigh vacuum give the location and shifts of the surface potential. It is shown that the 1/f-noise is closely correlated to crystal surface properties. Noise intensity is determined by the location of the surface potential; it decreases with elimination of the inversion layer and surface potential shift towards concentration. Variations in surface potential are obtained by chemical and electrical effects. Silicon dioxide or silicon nitride layers stabilize the germanium surface so that atmospheric effects on the 1/f noise are eliminated. Transl. by G.G.

N71-31821# California Inst. of Tech., Pasadena. Dept. of Electrical Engineering.
ION IMPLANTATION AND BACKSCATTERING AND CHANNELING EFFECT MEASUREMENTS FOR ANALYSIS OF SEMICONDUCTOR STRUCTURES Final Report, Dec. 1967–Dec. 1970
Jozsef Gyulai, Nils G. E. Johansson, James W. Mayer, Ian V. Mitchell, Marc A. Nicolet et al 15 Jan. 1971 60 p refs
(Contract F19628-68-C-0142)
(AD-723300; AFCRL-71-0087) Avail: NTIS CSCL 20/12

There were two broad phases of investigation: ion implantation phenomena and evaluation of semiconductor structures by use of nuclear techniques. Both Hall and Channeling effect measurements were used to evaluate implanted layers. Evaluation of different dopant elements indicated similar behavior among species of the same column of the periodic table but different behavior between adjacent elements. During anneal sequences, enhanced diffusion of the implanted species towards the surface was found. Backscattering and channeling effect measurements were directed toward determination of the depth distribution and lattice location of dopant species and toward evaluation of the composition of dielectric layers on semiconductors. Diffusion and alloying behavior were also investigated. Author (GRA)

N71-31988# North Carolina Univ., Chapel Hill. Dept. of Physics.
STUDY OF RARE-EARTH IONS IN COLOR CENTERS Final Report
Dietrich Schroeer 31 Jan. 1971 9 p
(Contract AF-AFOSR-1716-69)
(AD-723735; AFOSR-71-0921TR) Avail: NTIS CSCL 20/12

The effects of heat treatments and of irradiation on the spinel Co3O4 doped with Co-57 have been studied. It appears that lattice defects are induced which remove the cubic symmetry at the tetrahedral cobalt lattice site. These lattice defects relax in times on the order of hours. A review has been presented of the capability of the Mossbauer effect to give information about lattice induced by irradiation, for example. The Mossbauer resonance of the 21.6-keV state of Eu-151 has been studied following Coulomb excitation with high-energy alpha particles. The Morin transition in hematite has been found, by computer analysis of Mossbauer spectra, to be first order to within 0.6K. Author (GRA)

N71-32057# Tyco Labs., Inc., Waltham, Mass.
ELECTRO-OPTIC MODULATORS Semiannual Report
Fritz V. Wald, Richard O. Bell, Andrew A. Menna, and Franklin H. Cocks Jan. 1971 59 p ref
(Contract F19628-70-C-0288; ARPA Order 1434)
(AD-721201; C-008; AFCRL-71-0104; AR-1) Avail: NTIS CSCL 20/2

The experimental work described in this report concerns the crystal growth of cinnabar, proustite, and lead-cesium-chloride by the Traveling Heater Method (THM). Also described is experimental work in the HgS-HgI2 phase diagram which leads to the conclusion that a ternary compounds Hg3S2I2 which is isomorphous with gamma Hg3S2Cl2 exists. Theoretical work reported concerns the calculation of electrooptic coefficients for compounds with zincblende structure using Phillips electronegativities, crystallographic data and electronic polarizability of the atoms in the lattice as basic parameters. The method used here is believed to be generally applicable to other structure types and can probably also be further extended to cover other electroptic properties. Author (GRA)

N71-32072# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Material und Festkoerperforschung.
EXPERIMENTAL CONTRIBUTION TO JOST MECHANISM IN SOLID STATE REACTIONS [EXPERIMENTELLE BEITRAEGE ZUM JOST-MECHANISMUS BEI FESTKOERPERREAKTIONEN]
H. Kleykamp 22 Dec. 1970 17 p refs In GERMAN; ENGLISH summary Presented at Conf. on Transport Processes in Inorg. Nonmetallic Raw Mater. and Struct. of these Mater., Mainz, 10 Apr. 1969
(KFK-1312; Conf-690455-1) Avail: AEC Depository Libraries

In solid state reactions with two initial phases the double decomposition AX + BY = AY + BX takes on a particular form. After reacting, following the Jost mechanism, the products form layers between the initial phases. The order of these layers depends on the mobility of the ions taking part in the reaction. Extreme cases are illustrated using microstructure pictures and microanalysis investigations as well as reaction kinetics observations. The reaction ZnS + CdO yields ZnO + CdS is a process of simultaneous cation diffusion, the reaction UN + ZrO2 yields UO2 + ZrN one of simultaneous anion diffusion. If the cations and anions are predominantly mobile in one component, then the Kirkendall effect will possibly occur to the products following the Jost mechanism. As examples, the reaction PbCl2 + BaO yields PbO + BaCl2 and UAl3 + Al yields UAl4 in the case of only one mobile component are discussed. Author (NSA)

N71-32155# Rochester Univ., N.Y. Dept. of Chemical Engineering.
THE DETERMINATION OF THE OPTICAL CONSTANTS OF AMORPHOUS THIN FILMS OF SELENIUM AND ARSENIC TRISELENIDE FROM INFRARED REFLECTIVITY SPECTRA
Final Technical Report No. 4
Gouq-Jen Su, Jan Bock, and C. C. Yang Apr. 1971 23 p refs
(Contract Nonr-668(19))
(AD-723833) Avail: NTIS CSCL 20/12

The reflectivity spectra of thin films of amorphous arsenic triselenide and selenium have been obtained. The films are deposited on aluminum substrates and have a range of thickness from 2 to 50 microns. The reflectivity spectra of these samples cover the region from 650 to 40 wavenumbers (15 to 250 microns). Author (GRA)

N71-32159*# Washington Univ., Seattle. Dept. of Aeronautics and Astronautics.
ONE-DIMENSIONAL LASER HEATING OF A STATIONARY PLASMA
Loren C. Steinhauer and Harlow G. Ahlstrom Washington NASA Aug. 1971 39 p refs
(Grants NGL-48-002-044; NSF GK-2694)
(NASA-CR-1854; Rept-69-5) Avail: NTIS CSCL 20E

The problem of laser energy addition to a nonuniform one-dimensional plasma is considered. The object is to study plasmas which may achieve temperatures and densities of interest for application to controlled thermonuclear reactions (CTR). The advent of the nanosecond and picosecond lasers makes it possible to consider the heating of stationary, non-thermally conducting plasmas with a nonuniform density distribution in which only the electrons are heated. The solutions show that for a wide range of relevant parameters these assumptions are valid. The temperatures that can be produced are of interest in CTR. Depending on the steepness of the density gradient, either wave-like or simultaneous heating is produced. Also, the temperature distribution is very much nonuniform and can significantly affect the subsequent dynamics of the plasma. Author

N71-32163*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
GRAPHITE MINORITY CARRIERS, FROM TRANSPORT MEASUREMENTS TO 10 TESLAS
John A. Woollam Washington Aug. 1971 16 p refs
(NASA-TN-D-6466; E-6334) Avail: NTIS CSCL 20L

Study of quantum oscillations in the Hall effect and thermoelectric-power indicates that there are at least two sets of minority carriers in graphite. Natural single crystals and pyrolytic graphite have the same minority Fermi surface sections, and their possible locations in the Brillouin zone are discussed. Under the assumption that the band parameter gamma sub 0 is 2.85 eV, the band parameter Delta is estimated to be +0.008 eV. Author

N71-32205# Aerospace Corp., El Segundo, Calif. Lab. Operations.
MISCELLANEOUS NOTES ON CRYSTALLOGRAPHY, JULY 1968–June 1970
Gerard M. Wolten 31 Dec. 1970 25 p ref
(Contract F04701-70-C-0059)
(AD-718094; TR-0059(6250-10)-7; SAMSO-TR-71-13) Avail: NTIS CSCL 20/2

The report contains three unrelated notes that represent crystallographic work performanced during 1968-70 in support of various projects that have been reported on separately. Part One discusses the reliability of the indexing of X-ray powder patterns and how it can be improved by the use of calculated intensities. Part Two reports an enhanced Renninger effect observed during the X-ray examination of high-purity solid solution crystals of Zr, HfO2. Part Three describes a new approach to the computer plotting of stereographic projections, which are widely used in metallurgical and mineralogical investigations. Author (GRA)

N71-32218# California Inst. of Tech., Pasadena. W. M. Keck Lab. of Engineering Materials.
HYPERFINE MAGNETIC INTERACTIONS IN FeGa SOLID SOLUTIONS
L. R. Newkirk and C. C. Tsuei Apr. 1971 22 p refs
(Contract AT(04-3)-822)
(CALT-822-27) Avail: NTIS

Mossbauer spectra were obtained for bcc Fe alloys containing up to 25 at.% Ga in solid solution. The spectra were analyzed in a manner which permits the study of the effect of configuration on hyperfine magnetic field and isomer shift with very few prior assumptions. Various assumptions commonly made in handling this type of data were examined in detail and their validity tested. The details of 16 different configurations are presented along with an empirical formula to describe the hyperfine field as a function of configuration and concentration. Author

N71-32220# Institute of Nuclear Research, Warsaw (Poland).
MAGNETIC STRUCTURE OF A MANGANESE-SUBSTITUTED ZINC FERRITE BY NEUTRON DIFFRACTION
Mohamed Khorshid Fayek 1971 74 p refs
(INR-1269) Avail: AEC Depository Libraries

The magnetic structure of Zn(0.87)Mn(0.13)Fe2O4 was studied by neutron diffraction. At 11 K, long range antiferromagnetic order appears. The volume of the magnetic unit cell is twice the chemical one. A non-collinear model for the magnetic structure is proposed. Half of the magnetic moments lie in the basal plane, and the second half along the axis. At 4.2K, the Fe(3+) moment is calculated. Author

N71-32270 University of Southern Calif., Los Angeles.
HIGH TEMPERATURE HALL EFFECT MEASUREMENTS ON Cd RICH CdS
George Howard Hershman (Ph.D. Thesis) 1969 115 p
Avail: Univ. Microfilms Order No. 70-16867

The dominant electrically active defect produced by the incorporation of excess Cd into CdS was investigated by performing Hall effect and resistivity measurements on undoped single crystal samples in equilibrium with known partial pressures of Cd vapor at temperatures between 400 and 1000 C. It was found that the carrier concentration varied as p sub Cd(1/3) for temperatures greater than 700 C. This indicated that the excess Cd was incorporated with the formation of a doubly ionized donor defect, either a Cd interstitial atom or a sulfur vacancy. The equilibrium constant for the incorporation of the doubly ionized defect was calculated and the incorporation energy was found to be approximately 1.70 eV. A search was made for an acceptor impurity with a solubility in CdS under Cd vapor pressures, in the range of 10 to the 16 power to 10 to the 17th power/cu cm. Hall mobilities were measured between 400 and 1000 C. The mobility was found to vary as T(−1.4) over this temperature range. Dissert. Abstr.

N71-32282 National Lending Library for Science and Technology, Boston Spa (England).
THE NATURE, SIZE AND DISTRIBUTION OF LATTICE DEFECTS IN THE TYPE 3 SUPERCONDUCTOR Nb-Zr25 AND THEIR INFLUENCE ON THE HIGH FIELD PROPERTIES
H. Hillmann et al Sep. 1970 13 p refs Transl. into ENGLISH from Z. Metallk. (Stuttgart), v. 58, no. 2, Feb. 1967 p 129–135
(NLL-CE-Trans-5350-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The occurrence, size, and distribution of lattice defects in

the alloy NbZr-25 were investigated by optical and electron microscopy. The dimensions and concentrations of dislocations, sub-bands and Guinier–Preston zones are consistent with those required for the pinning mechanism in the Type III superconductor. The formation of Guinier–Preston zones depends on the kinetics of the beta decomposition. This in turn is sensitive to interstitial impurities. The effect of various types of defects on the critical current density is demonstrated. This is moreover very sensitive to the way in which the defects are distributed; sub-bands and sub-band boundaries resulting from the cold work play a major role.
Author

N71-32317# Kentucky Univ., Lexington. Research Foundation.
NEW TECHNIQUE FOR MEASURING THE AMBIPOLAR DIFFUSION LENGTH IN THE ELEMENTAL SEMICONDUCTORS Progress Report
James Houston Logsdon (Ph.D. Thesis) 1970 96 p refs
(Contract AT(40-1)-3651)
(ORO-3651-8) Avail: NTIS

A method for determining the ambipolar diffusion coefficient in semiconductors via measurements of the ambipolar diffusion length and the excess carrier lifetime is described. This method which is equally applicable in any resistivity range, lends itself to measurements in the very significant range of semiconductors in the high purity state, where inherent limitations make it unfeasible to determine the mobility of the charge carriers directly by Haynes–Shockley measurements, or to infer the mobility of the charge carriers from measurements of the Hall coefficient and electrical conductivity alone. Being equally applicable in all resistivity ranges, the ambipolar diffusion coefficient is a good quantity to measure in studies of the influence of neutron irradiation on the transport properties of the charge carriers. The theoretical calculations were based on a one-dimensional model in which surface recombination was neglected. Experimentally this condition was approximated by the choice of a particular geometry for the test specimen as well as surface treatment to reduce the surface recombination.
Author

N71-32351 New York Univ., N.Y.
A PSEUDO-POTENTIAL CALCULATION OF ENERGY BANDS AND OPTICAL PROPERTIES OF 4-LASER POLYTYPE ZnS
Abel Rosato (Ph.D. Thesis) 1969 90 p
Avail: Univ. Microfilms Order No. 70-16098

A calculation of the energy band of 4 layer polytype of ZnS was made using the empirical pseudo-potential method of Cohen and Bergstresser. The real and imaginary part of the dielectric constant and the reflectivity are calculated and compared to Baars' experimental results. The linear decrease of the gap with increasing portion of the cubic packing is checked for 2,4,6, layer polytypes.
Dissert. Abstr.

N71-32387 California Inst. of Tech., Pasadena.
PROPERTIES OF ALPHA-MONOCLINIC SELENIUM
Joseph Dean Taynai (Ph.D. Thesis) 1970 108 p
Avail: Univ. Microfilms Order No. 70-14850

The growth of bulky and platelet shaped alpha-monoclinic crystals is discussed. A simple method is devised for identifying and orienting them. The density, previously in disagreement with the value calculated from X-ray studies, is carefully redetermined, and found to be in good agreement with the latter. A two parameter model is derived which explains the anisotropy in the relative dielectric constant of orthorhombic sulfur, which is also composed of 8-atom puckered ring molecules. The model works less well for alpha-monoclinic selenium. The relative dielectric constant anisotropy is quite noticeable, being 6.06 along the crystal b axis, and 8.52–8.93 normal to the axis. Thin crystal platelets of alpha-monoclinic selenium (less than 1 micron thick) are used to extend optical transmission measurements up to 4.5 eV.
Dissert. Abstr.

N71-32402 Pittsburgh Univ., Pa.
DEFORMATION OF INDIUM
Donald Lee Harrod (Ph.D. Thesis) 1969 110 p
Avail: Univ. Microfilms Order No. 70-16367

Slip, twinning and deformation (kink) bands were observed as operative modes of deformation in indium single crystals strained in tension in the temperature range 0.01 to 0.95 T sub m (T sub m = 428 K). The crystallography of these modes of deformation was determined by surface trace analyses using optical microscopy in conjunction with Laue X-ray diffraction patterns. Indium has a tetragonal crystal structure and can be indexed as either face-centered-tetragonal or body-centered-tetragonal. The two descriptions differ merely by a 45 deg rotation about the C-axis. The slip planes were identified as /111/, (112), (212), (113) and /101/. Twinning was observed as a prominent mode of deformation only at 0.01 T sub m. The twinning system was identified as /101/ <101>. Deformation (kink) bands were observed on several crystals. The critical resolved shear stress decreased from 80–90 psi at 0.01 T sub m to 10–20 psi at 0.95 T sub m, though this is not based on a fixed slip system.
Dissert. Abstr.

N71-32429# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
INVESTIGATION OF ELECTRON LATTICE STRUCTURE BY POSITRON ANNIHILATION IN SOME INSULATORS [CONTRIBUTION A L'ETUDE DE LA STRUCTURE ELECTRONIQUE DES ISOLANTS PAR ANNIHILATION DU POSITON]
Gerard Coussot (Ph.D. Thesis – Paris Univ., Orsay) Feb. 1971 142 p refs In FRENCH
(CEA-R-4138) Avail: AEC Depository Libraries

The angular distribution of gamma quanta resulting from positron annihilation in single insulator crystals was measured with long-slit-geometry apparatus for intense positron sources. Two new phenomena were observed in the angular correlation curves. In the fcc MgO, UO2 and CaF2 crystals, modulations appeared at angles corresponding to the limit of the first Brillouin zone in relation to the crystallographic direction studied. In SiO2, MgF2, MnF2 crystals, a narrow peak at 0 mrad and a fine structure superimposed on the broad distribution were resolved. The fine structure correlated with the narrow component is characterized by modulations appearing at angles corresponding to the projection of reciprocal lattice vectors along the crystallographic direction investigated. A systematic research of optimal observation conditions shows that the intensity of the narrow component is closely correlated with the purity and the perfection of the crystal where p–Ps is presumably formed.
Author (NSA)

N71-32437*# North Carolina State Univ., Raleigh. Dept. of Electrical Engineering.
AN EVALUATION OF SOLID STATE PHENOMENA AND DEVICES FOR SENSOR APPLICATIONS Final Report
L. K. Monteith, M. A. Littlejohn, and J. R. Hauser Jan. 1971 627 p refs
(Contract NAS1-9316)
(NASA-CR-111873) Avail: NTIS HC$9.00/MF$0.95 CSCL 20L

Bulk and semiconductor junction phenomena are studied, and the state-of-the-art of sensors is assessed with emphasis on their limitations. The following observations and recommendations are made: The character of the semiconductor industry is likely to become more consumer oriented. The R and D effort will decrease and research will swing toward high volume electronics. Consequently, NASA will find industry increasingly unresponsive to its sensor needs and it is recommended that NASA establish a strong in-house sensor development program based on contemporary solid state technology. The recommended priority for the sensor R and D effort is improvement of presently available sensors, exploitation of previously identified effects, study of new materials, and search for new phenomena. There appears to be no reason why

the magnetic properties of a large class of materials (ferrimagnetic for example) could not and should not be used as sensors. Thin film technology is advanced to the point where it could be used effectively for producing bulk sensors. The electrical properties of the transition metal compounds should be investigated for possible application to stress and temperature sensors. Ultraviolet sensors using bulk or junction effects appear to be feasible. Author

N71-32634 National Lending Library for Science and Technology, Boston Spa (England).
ISOEPITAXIAL LAYERS ON SILICON, PRODUCED BY CHEMICAL MEANS
S. Flaks et al 8 Oct. 1970 15 p Transl. into ENGLISH from Cables et Transmission (France), v. 24, no. 1, 1970 p 62–72
(NLL-PORS-Trans-2690-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

After summarising the qualitative theory of epitaxial growth, the advantages of using this method for the manufacture of components are shown. A description is given of the main difficulties encountered in the method, and of the apparatus which was developed. A description of methods of determining the quality and characteristics of a layer formed by epitaxial deposition and the results are presented. Author

N71-32617 Minnesota Univ., Minneapolis.
FLUCTUATION STUDIES IN MERCURY CADMIUM TELLURIDE
Raghu Nandan Sharma (Ph.D. Thesis) 1969 126 p
Avail: Univ. Microfilms Order No. 70-15812

Electrical and optical properties of mercury cadmium telluride were investigated with emphasis on carrier density fluctuations. Crystals with bandgap of .082 eV, corresponding to a long wavelength limit of 15 microns were studied. Causes of fluctuations in photoconductors are described, and their relevance to the use of mixed crystals is discussed. The electronic structure of this material, particularly its relevance to the electron-hole statistics necessary for the study of noise is examined and the band structure discussed. The expected generation-recombination noise in a near intrinsic semiconductor is also treated, including the effect of the crystal temperature and the background radiation on three types of lifetime. Finally experimental results of noise, both in thermal equilibrium (crystal temperature ranging from 77 K to 110 K) and as exposed to various kinds of black body radiation (300 K, 500 K), are given. Dissert. Abstr.

N71-32642 Pittsburgh Univ., Pa.
MAGNETIC COUPLING AND PHASE BOUNDARIES FOR SOME C15 AND C22 PSEUDO BINARY ALLOYS CONTAINING LANTHANIDES
Burke Leon (Ph.D. Thesis) 1969 168 p
Avail: Univ. Microfilms Order No. 70-14833

Magnetic and structural properties were determined for a series of pseudo binary alloys of the C15 and C22 structures. These alloys are characterized as LnNi(x)Al(2-x) and Pr(x)Ln(1-x)T(2) where Ln = Ce, Pr, Nd, Gd, Tb, Dy, Ho, Er, Y, and Lu for the first case, and Ln = Dy and Ho, and T = Ni and Co for the second case. Samples were prepared by induction melting and their crystal structures examined by powder X-ray diffraction. Magnetic susceptibilities were determined by the Faraday method. Susceptibilities were measured as a function of temperature over the range 4.2 K to 300 K, and as a function of selected field strength values between 2 and 20 kOe. The phase diagrams were determined for all cases. For the LnNi(x)Al(2-x) system, the phase diagram from x = 0 to x = 2 consisted of two terminal regions of C15 structure separated from a central region of C22 structure by two phase regions. Dissert. Abstr.

N71-32702# Northeastern Univ., Boston, Mass. Solid State Spectroscopy Lab.
THE STUDY OF THE REFLECTIVITY OF INORGANIC MATERIALS IMPORTANT FOR REMOTE SENSING APPLICATIONS Final Report, 15 Sep. 1968–15 Sep. 1970
Clive H. Perry and Robert P. Lowndes Nov. 1970 129 p refs
(Contract F19628-69-C-0081)
(AD-720874; AFCRL-70-0512) Avail: NTIS CSCL 20/12

The influence of phase angle, compactness of material and particle size on the total reflectivity in the frequency range 10-10,000/cm on a variety of inorganic materials is presented. The determination of the k about 0 longitudinal optic frequencies and lifetimes from the dielectric and inverse dielectric response functions of simple cubic solids is discussed. The results of the temperature dependence over the range 5-400K of the k about LO frequencies and lifetimes of 18 alkali and thallium halides are given. In addition, the pressure dependence up to 5 kilobars at 290K of the LO frequencies of RbI, CsBr and CsI is reported. Far infrared transmittance and reflection spectroscopic measurements at near normal incidence and Raman spectroscopic measurements are reported for polycrystalline thallous iodide in the temperature range 5-550K. The results of reflectivity measurements as a function of phase angle for fused quartz and calcite single crystals are presented together with the reflectivities as a function of particle size, packing fraction and phase angle for powdered samples of quartz and calcite. A measurement and a discussion of the far infrared Stark and Zeeman splittings of Er(3+) in the rare earth fluorides is given. The occurrence of silicon monoxide bands in some low temperature stars is also discussed. Author (GRA)

N71-32776# California Inst. of Tech., Pasadena. W. M. Keck Lab. of Engineering Materials.
MOESSBAUER STUDY OF BiF3 TYPE ORDERING IN METASTABLE FeGa ALLOYS
L. R. Newkirk and C. C. Tsuei Apr. 1971 13 p refs
(Contract AT(04-3)-822)
(CALT-822-26; AEC-RD-21) Avail: NTIS

Metastable Fe alloys containing up to 25 at.% Ga, obtained by rapidly quenching from the liquid state, were studied using the Mossbauer effect. A least squares analysis of the data allowed identification of individual configurations of atoms surrounding each Fe atom, and the comparison of these configurations with various ordered and disordered states. Partial ordering of the BiF3 type was definitely observed at 25 at.% Ga, and the results suggest that it may extend to compositions as low as 20 at.% Ga. Author

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N71-31801# Brigham Young Univ., Provo, Utah. Dept. of Chemical Engineering.
COMBUSTION TERMINATION OF SOLID PROPELLANT MOTORS Interim Report
R. L. Coates and M. D. Horton Apr. 1971 59 p refs
(Grant AF-AFOSR-1895-70)
(AD-723680; AFOSR-71-1230TR) Avail: NTIS CSCL 21/2

An extensive analysis has been made of published characteristic chamber length instability data using a linearized form of the model. The steady-state burning rate exponent has been shown to be the most sensitive propellant parameter governing marginal stability conditions. Data for different propellants have been

quantitatively compared with theoretically predicted marginal stability conditions. Comparison between the predicted and measured characteristic chamber lengths and frequencies versus operating pressure was found to be relatively good, and it is encouraging to note that the kinetic parameters found to correlate the characteristic chamber length instability data are of the same order of magnitude as those previously found to correlate extinguishment data. A device for measuring the effect of external thermal radiation on steady-state burning rates has been designed, fabricated, and assembled. Author (GRA)

N71-31948# Air Force Systems Command, Edwards AFB, Calif. Rocket Propulsion Lab.
A TECHNIQUE TO MEASURE THE IRRADIANCE OF A BURNING SOLID PROPELLANT SURFACE Technical Report, Oct. 1968 – Oct. 1970
Richard F. Felton Apr. 1971 133 p ref
(AD-723283; AFRPL-TR-71-40) Avail: NTIS CSCL 21/2

A simple, reliable experimental technique has been developed to measure the irradiance of the burning surface of a solid propellant. It incorporates an optical lightpipe to transmit incident radiant energy to a radiation detector. The detector used for the majority of the development tests was a solid state silicon detector with a time constant of less than 500 microseconds. Tests were conducted mainly on metallized, composite and composite modified double base propellants. The metallic additive was aluminum; its percentage by weight varied from 8 percent to 17 percent. The pressure range investigated was 1 to 35 atmospheres with gaseous nitrogen used to pressurize and purge the combustion bomb. Burn rate measurements were made on short propellant samples using electrical timing wires to indicate the time it takes to burn a known length of propellant. Author (GRA)

N71-32050# Naval Research Lab., Washington, D.C.
SUPPRESSION OF FUEL EVAPORATION BY AQUEOUS FILMS OF FLUOROCHEMICAL SURFACTANT SOLUTIONS Interim Report
Harry E. Moran, Jack C. Burnett, and Joseph T. Leonard 1 Apr. 1971 23 p refs
(AD-723189; NRL-7247) Avail: NTIS CSCL 21/4

Solutions of aqueous fluorochemical surfactants were placed on the surface of liquid hydrocarbons and hydrocarbon fuels to study the film-forming ability of the surfactant solutions. Spreading coefficients were calculated for a number of surfactant solution/hydrocarbon liquid pairs and correlations made with visual observations of film formation. In a majority of cases, film formation could be predicted from the spreading coefficient of the surfactant solution on the hydrocarbon substrate. Both pure fluorochemical surfactants and commercially available fire fighting concentrates were used to prepare the aqueous solutions. The hydrocarbon liquids and fuels included n-heptane, isooctane, cyclohexane, jet fuels JP-4 and JP-5, motor fuel (gasoline), and stove and lighting naphtha. The effect of temperature on surface and interfacial tension measurements was also studied. In general, the surface tensions of the hydrocarbon liquids and the interfacial tensions between the surfactant and hydrocarbon liquid pairs decreased at a rate of approximately 0.07 to 0.12 dynes per cm per deg C temperature rise. The surface tensions of the surfactant solutions were found to decrease approximately 0.05 to 0.06 dynes per cm per deg C rise. Author (GRA)

N71-32073# Stanford Research Inst., Menlo Park, Calif.
INVESTIGATION OF LOW-VELOCITY DETONATION PHENOMENA IN LIQUID PROPELLANTS. FUELS AND EXPLOSIVES Annual Progress Report, 1 Mar. 1970 – 28 Feb. 1971
D. C. Wooten and M. Cowperthwaite 19 Apr. 1971 26 p refs
(Contract F44620-69-C-0079)
(AD-723677; AFOSR-71-1231TR) Avail: NTIS CSCL 19/4

A theoretical model based upon a reactive shock propagating into a cavitated liquid is developed. The compressed cavitation zone is taken to be in mechanical equilibrium and forms a steady-state reaction zone, terminating in a state of complete reaction. Detonation parameters computed for ethyl nitrate give a detonation velocity that is too high by approximately a factor of two. It is concluded that the equilibrium assumption is too restrictive and that nonequilibrium effects must be included in the model. Author (GRA)

N71-32074# Defense Documentation Center, Alexandria, Va.
FUEL AND PROPELLANT TANKS, VOLUME 1 Report Bibliography, Sep. – Oct. 1970
May 1971 78 p refs
(AD-723920; DDC-TAS-71-15-1-Vol-1) Avail: NTIS CSCL 13/4

Unclassified annotated references are compiled from the Defense Documentation Centers holding on tanks. The topics and subjects covered vary from anti-icing, anti-bacterial additives, to the vibrational, and structural effects of space environmental conditions and travel. Author (GRA)

N71-32078# Dow Chemical Co., Midland, Mich.
CHEMICAL AND PHYSICAL STUDY OF FUELS GELLED WITH HYDROCARBON RESINS Final Report, 22 Jun. 1970 – 2 Feb. 1971
R. E. Erickson and R. M. Krajewski Jul. 1971 104 p
(Contract DOT-FA70NA-496)
(FAA-NA-71-17; FAA-RD-71-34) Avail: NTIS

A gelled fuel was modified to achieve low viscosity at low shear while maintaining significant resistance to fire while in the misting condition. The modified gelled fuel has been rheologically profiled using a variety of rheometers. Test data on flowability, rheological characteristics, and simulated crash fire misting hazard are included in the report. Author

N71-32087*# National Aviation Facilities Experimental Center, Atlantic City, N.J.
SMALL SCALE IMPACT TESTS OF CRASH SAFE TURBINE FUELS Final Report, 1964 – 1970
Ralph A. Russell, Jr. Aug. 1971 48 p refs
(FAA-NA-71-12; FAA-RD-71-49) Avail: NTIS

A variety of regular and modified hydrocarbon-turbine fuels, one nonhydrocarbon fuel, and reticulated polyurethane foam filled with neat fuel was subjected to small-scale impact tests to determine burning, misting, and splatter characteristics of the fuels. The results of this study conclude that it is entirely feasible to retard the ignitibility, combustibility, and flow characteristics of current hydrocarbon fuels by increasing their apparent viscosity. The study showed that non-Newtonian gelled fuels performed better than other modified fuel candidates and better than the reticulated polyurethane foams filled with neat fuel. Author

N71-32475*# TRW Systems Group, Redondo Beach, Calif.
STUDY OF THE FORMATION AND BEHAVIOR OF CLOGGING MATERIAL IN PROPELLANTS (OXYGEN DIFLUORIDE AND DIBORANE) Final Report, 13 Apr. 1970 – 13 Jan. 1971
Jan. 1971 61 p refs Prepared for JPL
(Contract NAS7-787)
(NASA-CR-121282; TRW-16898-6009-R0-00) Avail: NTIS CSCL 21I

Approximately one hundred flow tests were conducted flowing liquid diborane through a 0.010 inch diameter and a 0.020 inch diameter orifice, a 2 micron nominal - 10 micron absolute rated filter and a 10 micron absolute rated acquisition screen. Within the

test conditions reported it was concluded that diborane does not exhibit flow anomalies caused by the formation of clogging materials or any polymorphic changes inherent in the liquid diborane. Liquid oxygen difluoride flowing through a 0.010 inch diameter orifice, a 2–10 micron filter and a 10 micron acquisition screen showed no evidence of flow clogging or flow decay. Author

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N71-31666# Laboratoire d'Automatique et de ses Applications Spatiales, Toulouse (France).
ELECTRIC POWER SUPPLIES REQUIRED FOR ION PROPULSION: PRINCIPAL CHARACTERISTICS [ALIMENTATIONS ELECTRIQUES NECESSAIRES A LA PROPULSION IONIQUE: PRINCIPALES CARACTERISTIQUES]
C. Landrault, P. Luquet (CNES), and M. Briot Jan. 1971 40 p refs In FRENCH
(LAAS-756) Avail: NTIS

Based on a bibliographic survey the main ion thrustors are reviewed. The different electric power supplies and their characteristics are discussed. A project of microthrustors designed for CNES is presented. ESRO

N71-31698# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
EXPLORATORY INVESTIGATION OF JET ENGINE SILENCING WITH PLUG NOZZLE CONFIGURATIONS
Terry D. Scharton, Benjamin J. Pinkel, and Suyed Tomooka 16 Apr. 1971 22 p refs
(Contract DOT-FA-SS-71-6)
(AD-722851; BBN-2089) Avail: NTIS CSCL 21/5

The objective in the present exploratory investigation was to determine experimentally whether significant silencing could be obtained with noise suppressors that could be conveniently incorporated within the plug nozzle configuration. The 1/3-octave band sound power radiated by the plug nozzle incorporating various suppressor concepts was compared with that of the conventional converging-diverging nozzle and with that of the conventional multi-tube nozzle noise suppressor. Comparisons were also made of the measured thrust of the various nozzles and of the directivity of the radiated sound. Shadow-graph pictures of the flow from some of the nozzles were obtained. The tests were made mainly at a ratio of nozzle total pressure to ambient pressure of 3 which is representative of the pressure ratios during take-off in high performance turbojet engines (jet Mach number approximately 1.4). Author (GRA)

N71-31767# Argonne National Lab., Ill. Engineering and Technology Div.
INVESTIGATION OF LIQUID-METAL MAGNETOHYDRODYNAMIC POWER SYSTEMS Annual Report, 1 Nov. 1969 – 1 Nov. 1970
Michael Petrick, William E. Amend, Edward S. Pierson, and Chun Hau Dec. 1970 162 p refs
(Contracts NAonr-12-70; NAonr-7-71)
(AD-721087; ANL/ETD-70-12) Avail: NTIS CSCL 10/2

Detailed cycle and component analysis were performed to: establish overall efficiency and performance characteristics of a low-temperature, two-phase, liquid-metal MHD power cycle; and to identify and evaluate critical problem areas that require research and development programs. First, a mathematical model, which calculates individual component efficiency and overall cycle efficiency for a single-state concept, was developed and programmed for a digital computer. Next, a Standard Cycle was established and adopted for comparison studies in which major cycle parameters, generator parameters, and working fluids were varied to evaluate their effect on overall system performance. Author (GRA)

N71-31762# IIT Research Inst., Chicago, Ill.
DEVELOPMENT OF PARTICULATE EMISSIONS CONTROL TECHNIQUES FOR SPARK IGNITION ENGINES Final Report, Jun. 1969 – Nov. 1970
Sudesh K. Sood and Richard Karuhn Feb. 1971 98 p refs
(Contract CPA-22-69-134)
(PB-198033; IITRI-C6186-5) Avail: NTIS CSCL 13B

Experimental results of two techniques for the removal of particulate contaminants from spark ignition engine exhausts are reported. The first technique was based on the thermal deposition of lead aerosol particles in the size range 0.1 - 0.8 microns in a packed bed. The effect of gas-packing temperature differential, packing material, packing shape and size, contamination buildup, and gas velocity on collection efficiency of the bed was studied. Experimental results show that collection efficiency of the packed bed device depends primarily on the gas-packing temperature differential. The second technique was based on the use of sonic waves to increase the collisions between the aerosol particles and the relatively coarse particles, of a fluidized bed, and hence increase the collection efficiency. The effect of sound frequency, gas velocity, and power input to the sound driver units was studied. Experimental results showed that there was no significant effect of sound frequency, in the range 250 to 2700 HZ, on collection efficiency of the fluidized bed. Author (GRA)

N71-32059# North American Rockwell Corp., Columbus, Ohio.
INTERNAL AERODYNAMICS MANUAL, VOLUME 1
Jun. 1970 426 p refs
(Contract NOw-66-0460-d)
(AD-723823; NR68H-434-Vol-1) Avail: NTIS HC $6.00/MF $0.95 CSCL 21/5

The Internal Aerodynamics Handbook has been developed in order to provide a convenient, accurate and reliable internal aerodynamics design manual which enables rapid determination of the internal airflow effects on airplane performance. It also enables the computation of internal airflow systems performance by developed theoretical and empirical methods. The scope of the design manual relates specifically to internal aerodynamics for the complete aircraft speed range up to and including Mach 3.5. In addition to the detailed data and methods presentation, an extensive bibliography is provided. Author (GRA)

N71-32060# North American Rockwell Corp., Columbus, Ohio.
INTERNAL AERONAUTICAL MANUAL, VOLUME 2
Jun. 1970 516 p refs
(Contract NOw-66-0460-d)
(AD-723824; NR68H-434-Vol-2) Avail: NTIS HC $6.00/MF $0.95 CSCL 21/5

The Internal Aerodynamics Handbook has been developed in order to provide a convenient, accurate and reliable internal aerodynamics design manual which enables rapid determination of the internal airflow effects on airplane performance. It also enables the computation of internal airflow systems performance by developed theoretical and empirical methods. The scope of the design manual relates specifically to internal aerodynamics for the complete aircraft speed range up to and including Mach 3.5. Author (GRA)

N71-32061# North American Rockwell Corp., Columbus, Ohio.
INTERNAL DYNAMICS MANUAL, APPENDIX
Jun. 1970 597 p refs
(Contract NOw-66-0460-d)
(AD-723841; NR68H-434-App) Avail: NTIS HC $6.00/MF $0.95
CSCL 21/5

The report is organized into six sections and consists of tabulations that will facilitate theoretical thermodynamic calculations. These sections of the Appendix are: basic thermodynamic relationships, normal shock wave parameters, two-dimensional shock wave parameters, three-dimensional shock wave analysis,corrected weight flow parameters, and parameters for thrust calculation. Author (GRA)

N71-32076# Purdue Univ., Lafayette, Ind. Project Squid Headquarters.
A COOPERATIVE PROGRAM OF FUNDAMENTAL RESEARCH RELATED TO JET PROPULSION Semiannual Progress Report, 1 Oct. 1970 - 31 Mar. 1971
1 Apr. 1971 106 p refs
(Contract N00014-67-A-0226-0005; Proj. Squid)
(AD-723807) Avail: NTIS CSCL 20/4

Reports of progress on the 18 research programs comprising Project SQUID are presented. The research programs fall into the areas of fluid mechanics, atomic and molecular collisions, combustion and chemical rate processes, and chemi-ionization and ion-molecular reactions. Project SQUID is a cooperative program of basic research related to jet propulsion. Author (GRA)

N71-32144*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INFLIGHT THRUST MEASURING SYSTEM FOR UNDERWING NACELLES INSTALLED ON A MODIFIED F-106 AIRCRAFT
Harold W. Groth, Nick E. Samanich, and Philip Z. Blumenthal Washington Aug. 1971 33 p refs
(NASA-TM-X-2356; E-5557) Avail: NTIS CSCL 21E

An F-106 aircraft was modified for use as a flight test bed to evaluate powerplant system performance using two underwing nacelles containing afterburning J85-13 engines. A calibration program was conducted to determine the random error of the thrust measuring system in evaluating flight performance of exhaust nozzles. The random error in the determination of a nacelle tare drag was nearly Gaussian and provided a repeatability of + or - 1.0 percent in the calculation of nozzle performance for 68 percent of the data. Author

N71-32158*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPARISON OF PREDICTED AND EXPERIMENTAL WALL TEMPERATURES FOR A CYLINDRICAL EJECTOR EXHAUST NOZZLE OPERATED WITH A TURBOJET GAS GENERATOR
Arthur Lieberman Washington Aug. 1971 57 p refs
(NASA-TN-D-6465; E-6300) Avail: NTIS CSCL 21E

The shroud wall temperatures during operation with and without an afterburner are predicted analytically by using a wall heat balance of hot gas radiation, coolant convection, internal and external radiation, and external free convection. The Hatch - Papell film-cooling correlation predicts an adiabatic wall temperature which is used as the driving temperature for the coolant heat transfer. Ejectors with nozzle area ratios from 1.65 to 2.75 and ejector length to primary diameter ratios from 1.63 to 1.95 were tested. Tests were conducted at nozzle pressure ratios ranging from 2.0 to 6.3, primary total temperatures from 861 to 1939 K (1550 to 3490 R), and corrected secondary weight-flow ratios from 0.027 to 0.088. The predictions yielded reasonably good results throughout the range of conditions tested. Author

N71-32279*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
EVALUATION OF CONVERTERS FUELED WITH URANIUM NITRIDE
K. Shimada and P. L. Cassell 30 Jul. 1971 22 p refs
(Contract NAS7-100)
(NASA-CR-119690; JPL-TM-33-489) Avail: NTIS CSCL 21C

Two thermionic energy converters fueled with uranium nitride were fabricated and subjected to comprehensive tests to evaluate their performance as nuclear thermionic converters. Both converters had plane-parallel electrode geometry to increase the accuracy in making measurements of converter parameters and to simplify the laboratory testing which utilized an electron gun for the emitter heating. Of the two converters, one had a rhenium emitter and the other a tungsten emitter; the collector was niobium in both converters. The evaluation of fuel-emitter compatibility, which was the major objective of the laboratory tests, was performed by measuring and correlating converter characteristics and electrode work functions. The first phase of the evaluation, involving parametric testing, was completed. The initial performance of these converters was fully characterized so that any change that might occur during the second phase of the test, the life test, due to fuel-emitter interactions could be readily identified. Author

N71-32484*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF OPERATING VARIABLES ON POLLUTANT EMISSIONS FROM AIRCRAFT TURBINE ENGINE COMBUSTORS
Jack Grobman [1971] 41 p refs Proposed for presentation at 1971 Gen. Motors Lab. Symp., Warren, Mich., 27-28 Sep. 1971
(NASA-TM-X-67887) Avail: NTIS CSCL 21E

Combustor research aimed at reducing exhaust emissions from jet aircraft engines is reviewed. Experimental results of tests performed on both conventional and experimental combustors over a range of inlet total pressure, inlet total temperature, reference velocity, and fuel-air ratio are presented to demonstrate the effect of operating variables on pollutant emissions. Combustor design techniques to reduce emissions are discussed. Improving fuel atomization by using an air-assist fuel nozzle has been shown to significantly reduce hydrocarbon and carbon monoxide emissions during idle. A short-length annular swirl-can combustor has demonstrated a significant reduction in nitric oxide emissions compared to a conventional combustor operating at similar conditions. The use of diffuser wall bleed to provide variable control of combustor airflow distribution may enable the achievement of reduced emissions without compromising combustor performance. Author

N71-32492# Bureau of Mines, Bartlesville, Okla. Petroleum Research Center.
DIESEL EMISSIONS REINVENTORIED
W. F. Marshall and R. D. Fleming Jul. 1971 28 p refs
Sponsored in part by HEW
(BM-RI-7530) Avail: NTIS

Exhaust-emission data from 10 diesel engines: (1) six 4-cycle, direct-injection, naturally aspirated engines; (2) two 4-cycle, direct-injection, turbocharged engines; (3) one 4-cycle, precombustion-chamber, turbo-charged engine; and (4) one 2-cycle, direct-injection engine are presented. Lowest emissions were obtained with a precombustion-chamber engine. Emissions from the 2-cycle, direct-injection engine fell within the range of emission rates for the 4-cycle, naturally aspirated, direct-injection engines. Excluding the precombustion-chamber engine and excepting one of the 4-cycle, naturally aspirated engines, carbon monoxide emission rates were about the same for all engines tested. Test data on smoke, odor, and emissions of hydrocarbons, oxides of nitrogen, carbon monoxide, and aldehydes are given. Author

N71-32516*+ Electro-Optical Systems, Inc., Pasadena, Calif.
COMPOSITE ACCELERATOR GRID INVESTIGATION FOR CESIUM ELECTRON BOMBARDMENT ION THRUSTER Final Report, 28 May 1969 - 28 Apr. 1971
28 Apr. 1971 76 p refs
(Contract NAS5-21023)
(NASA-CR-119695) Avail: NTIS CSCL 21C

Various composite electrode configurations were investigated for application on cesium bombardment ion thrusters. Tests with cesium thrusters were concentrated on three types of electrodes: bonded metal-ceramic, glass-coated metal, and glass-coated ceramic bonded to metal. Techniques for brazing niobium to alumina were adapted to this effort. Design constraints due to anticipated launch vibrations were examined. Design and performance considerations are discussed along with operational test results. Author

N71-32621# National Research Council of Canada, Ottawa (Ontario). Div. of Mechanical Engineering.
FREE PISTON ENGINE HISTORICAL BACKGROUND AND RECENT STUDIES
J. J. Samolewicz *In its* Div. of Mech. Eng. and The Natl. Aeron. Estab. Mar. 1971 p 1-18 refs (See N71-32620 19-34)
Avail: NTIS

The free piston engine principle and its application history are briefly outlined for the two main forms: a self-contained free piston engine compressor and a gasifier in a compound free piston turbine engine. In the latter form it has found limited application in stationary power stations, and to a lesser extent, in marine propulsion. It is shown that the free piston engine can be developed in a wide power range as a reliable machine. It has failed, however, to prove itself as an engine of superior economy. Author

N71-32663# Chesapeake Coll., Wye Mills, Md.
PROCEEDINGS OF THE 12TH MEETING OF THE MECHANICAL FAILURES PREVENTION GROUP
W. T. Sawyer, ed. 13 Apr. 1971 44 p Conf. held at Warren, Mich., 8-9 Jul. 1970
(Contract N00014-69-C-0108)
(AD-721913; MFPG-6) Avail: NTIS CSCL 21/7

Report of three half-day discussions by a group of technical specialists of the problem of identification and prevention of mechanical failures in internal combustion reciprocating engine systems. Objectives were to identify the critical failure areas in these systems, the existing procedures for obtaining data from service failures, and the identification of technology to prevent or predict such failures. Ten prepared talks and accompanying audience discussions are reported. The chairman's general summary is included. GRA

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N71-31802# Imperial Coll. of Science and Technology, London (England). Dept. of Physics.
NOISE IN THE NEUTRAL SHEET IN THE GEOMAGNETIC TAIL Interim Scientific Report, 1 Dec. 1969 - 30 Nov. 1970
James W. Dungey 7 Jan. 1971 13 p refs
(Contract F61052-70-C-0009)
(AD-723654; SPT-71-1; AFCRL-71-0137) Avail: NTIS CSCL 4/1

Following the conclusion of Contract AF61(052)-927 the continuing effort concentrated on the self-consistent model of the undisturbed sheet, broken into two cases where the normal component of magnetic field is negligible and important. The former case is near completion, the most striking feature being the concentration of the potential drop at the dawn end of the sheet. The latter case is more difficult, but has been broken into two parts on the basis of a hopeful approximation. The self-consistent problem is like an optimisation problem, and a simple iterative scheme looks hopeful for the first part and programming is in progress. The second part may be suitable for the computational physics approach, but other optimisation techniques will be investigated. Author (GRA)

N71-31824# Air Force Cambridge Research Labs., Bedford, Mass.
IONIZATION RATES DUE TO THE ABSORPTION OF SOLAR PROTONS AND ALPHA PARTICLES IN THE UPPER ATMOSPHERE
William Swider and Margaret E. Gardner 22 Jan. 1971 23 p refs *Its* Environ. Res. Papers No. 367
(AD-723627; AFCRL-71-0059) Avail: NTIS CSCL 4/1

Ionization rates generated by atmospheric attenuation of solar protons and alpha particles, with integral exponential rigidity spectrums, are calculated for selected values of particle rigidity and geomagnetic cutoff. Ionization produced by these energetic particles creates polar cap absorption events, which disturb radio and radar communications. The ionization rates are required in order to formulate models for these events. Author (GRA)

N71-31941# Texas A and M Univ., College Station. Dept. of Physics
A PROGRAM TO DETERMINE FUNDAMENTAL NUCLEAR DATA FROM MUON INTENSITY MEASUREMENTS AND TO INVESTIGATE GEOPHYSICAL ASPECTS OF COSMIC RAYS AT HIGH ENERGIES Final Scientific Report
Nelson M. Duller 30 Mar. 1971 130 p refs
(Grant AF-AFOSR-1315-67)
(AD-723330; AFOSR-71-1202TR) Avail: NTIS CSCL 4/1

The final scientific report is presented on a comprehensive program planned to relate cosmic ray muon intensity measurements to theoretical calculations on the production and propagation of muons in the earths atmosphere. Complete theoretical treatment of several basic models of muon production is given, including special attention to effects of the geomagnetic field on muon charge ratios at observation. The experimental method of obtaining absolute intensities is described in some detail. Experimental results on muon intensities and charge ratios at a variety of zenith angles and at moments above 3 GeV/c are presented. Author (GRA)

N71-32051# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
SATELLITE DATA ANALYSIS FOR OPERATION PCA-69 ROCKET COORDINATION Final Technical Report, 1 May 1969 - 30 Mar. 1970
J. B. Reagan, W. L. Imhof, R. G. Johnson, and R. D. Sharp 26 Apr. 1971 48 p refs
(Contract N00014-70-C-0334)
(AD-722464; LMSC-N-HE-71-1) Avail: NTIS CSCL 3/2

Experiments on the OV1-18 satellite measured the energetic solar particle fluxes and the auroral particle fluxes during the Polar cap absorption event which began on 2 November 1969. The satellite observations were coordinated with the DASA PCA-69 rocket measurements at Fort Churchill, Canada. On the nightside near 0300 hours L.M.T., Fort Churchill was poleward (i.e., inside the polar cap) of the I/e cutoffs for 2-MeV protons throughout the event. On the dayside near 1300 hours L.M.T., Fort Churchill was near the I/e cutoffs for 2-MeV protons, being at times poleward and at other times equatorward of the cutoffs. Dayside and nightside energy distributions for solar flare electrons, protons, and

alpha particles are presented for the magnetic latitude of Fort Churchill. The energy distributions for the solar flare electrons, protons, and alpha particles and the observed temporal variations of these particles during the event are presented for the polar cap region. Auroral electrons were observed at or near the Fort Churchill magnetic latitude on every dayside and nightside overpass. The auroral electrons contribute significant ionization to the D-region below 92 km. Author (GRA)

N71-32075# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
A SIGNIFICANT SATELLITE RELATIVITY EXPERIMENT WITHOUT AN ATOMIC OSCILLATOR
Robert E. Jenkins Apr. 1970 23 p refs
(Contract NOw-62-0604-c)
(AD-716773; APL-TG-1114) Avail: NTIS CSCL 20/10

An experiment is proposed for an accurate and reliable measurement of the periodic relativistic doppler shift with a high-eccentricity, low-perigee-height orbit. Using a quartz crystal oscillator and existing proven hardware, the experiment would be both reliable and inexpensive with very little development required. An analysis is made of the errors in a previous similar experiment that was completed with the GEOS-I satellite. From the demonstrated capability in the GEOS experiment, it is concluded that a relative accuracy of better than 1% is attainable with an orbit eccentricity greater than 0.5. With an eccentricity as high as 0.9, the relative error would be of the order of 0.1%. Author (GRA)

N71-32190*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DERIVATION OF THE INTERNATIONAL GEOMAGNETIC REFERENCE FIELD, IGRF(10/68)
Joseph C. Cain and Shirley J. Cain Washington Aug. 1971 38 p refs
(NASA-TN-D-6237; G-1023) Avail: NTIS CSCL 20C

The results are summarized of the testing of the various magnetic field models against the available World Magnetic Survey data and describes the method by which the first International Geomagnetic Reference Field [IGRF(10/68)] was derived. The IGRF(10/68) was composed of contributions from the field models derived by Goddard Space Flight Center, Air Force Cambridge Research Laboratories, Royal Greenwich Observatory, Institute of Terrestrial Magnetism and Radiowave Propagation (IZMIRAN), and the U.S. Coast and Geodetic Survey. IGRF(10/68) is a set of 80 internal, spherical harmonic coefficients and their first time derivatives, epoch 1965.0, referenced to a sphere of radius 6371.2 km. The rms residuals to surface and airborne magnetic-survey data taken between 1961 and 1965 average approximately 200 gamma. The rms deviations from selected Cosmos 49 (1964.7) and POGO (1965.8–1967.9) satellite observations of total field range from 30 gamma to 60 gamma. Author

N71-32230*# Scientific Translation Service, Santa Barbara, Calif.
A SPECTROMETER FOR MEASURING THE CHARACTERISTICS OF IONS IN THE PLASMA OF THE SOLAR WIND AND THE MAGNETOSPHERE [SPECTROMETR DLYA IZMERENIYA KHARAKTERISTIK IONOV V PLAZME SOLNECHNOGO VETRA I MAGNITOSFERY]
A. V. Bogdanov et al Washington NASA Aug. 1971, 12 p refs Transl. into ENGLISH of Acad. of Sci. (USSR), Moscow. Inst. for Space Res. report Pr-62, 1971
(Contract NASw-2035)
(NASA-TT-F-13762) Avail: NTIS CSCL 03B

The principle and block diagram of instrumentation for onboard measurements of the energy spectrum of ion species H(+), He(+) and He(++) in space are given. This ion spectrometer consists of an electrostatic analyzer and magnetic analyzer with permanent magnet. For transmitting specific ions they are accelerated or decelerated before entering the magnetic analyzer. The voltage applied corresponds to the energy step of the electrostatic analyzer and to the ion species. An open electronic multiplier is used as the ion detector. The counting rate of the secondary multiplier is measured by a logarithmic intensimeter. For lower energies the energy resolution of the instrumentation is determined by the electrostatic analyzer, at higher energies, it is determined by the magnetic analyzer. Both calculated and measured characteristics of the device are given. Author

N71-32254 New York Univ., N.Y.
HIGH RESOLUTION, HIGH DISPERSION, TIME DEPENDENT, INTEGRATED DISC STUDIES OF THE SOLAR SPECTRUM
Bernard Raymond Eichenbaum (Ph.D. Thesis) 1969 145 p
Avail: Univ. Microfilms Order No. 70-16055

Two types of high-resolution, high-dispersion, time-dependent integrated-disc, solar-spectrum studies were initiated; profile studies of the Ca II H and K lines and position monitoring of the Mg 5172-A line. Two parameters of the integrated K-line profile were compared with the sun-spot number, an indicator of integrated-disc atmospheric activity that is based on spatially-resolved data. One parameter had a correlation coefficient of −0.622, the other +0.029. The possibility was investigated of radial gross normal modes of oscillation of the atmosphere that would be visible on the integrated-disc spectrum as time-dependent shifts in the position of the Mg 5172-A line. Assuming a monopole mode, preliminary observations place an upper limit of 30 m/sec rms on the velocity of possible gross oscillations. Dissert. Abstr.

N71-32277*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
X-RAY SPECTRA OF DISCRETE SOURCES IN CYGNUS
R. D. Bleach, E. A. Boldt, S. S. Holt, D. A. Schwartz, and P. J. Serlemitsos Jul. 1971 14 p refs Submitted for publication
(NASA-TM-X-65661; X-661-71-301) Avail: NTIS CSCL 03B

X-ray spectral data from a rocket-borne proportional counter exposure to discrete sources in Cygnus are presented. The data from Cyg X-1, Cyg X-2, and Cyg X-3 have sufficient statistical significance to clearly indicate mutually exclusive spectral forms for the three. Upper limits are presented for X-ray intensities above 2 keV for Cyg X-4 and Cyg X-5 (Cygnus Loop). Author

N71-32357 Florida State Univ., Tallahassee.
AN ANALYSIS OF THE INTENSITY FLUCTUATIONS PRODUCED BY THE INTERACTION OF THE DECAMETRIC RADIO EMISSION FROM JUPITER WITH THE INTERPLANETARY MEDIUM
Dale Lee Thompson (Ph.D. Thesis) 1969 196 p
Avail: Univ. Microfilms Order No. 70-16351

Interplanetary scintillation of the Jovian decametric radio emission by electron density inhomogeneities in the solar wind is considered for solar elongations of Jupiter greater than 90 deg. Under this circumstance, physical conditions favorable for quantitative specification of the statistical properties of the observed intensity fluctuations in terms of the character of the extended field of electron density inhomogeneities. The probability distribution of the intensity fluctuations is shown to be the Rice distribution. In addition, the intensity and phase fluctuation spectra are obtained as a function of the spectrum of the extended field of electron density irregularities. The results of a limited number of observations of the decametric radio emission at spaced sites and at a single site are also presented. Dissert. Abstr.

N71-32374*# Massachusetts Inst. of Tech., Cambridge. Dept. of Physics.

DETECTION OF HIGH-ENERGY X-RAY FLARE FROM A SOURCE IN CRUX

Walter H. G. Lewin, Jeffrey E. McClintock, Stanley G. Ryckman, and William B. Smith Mar. 1971 12 p refs
(Grant NGR-22-009-015)
(NASA-CR-119681) Avail: NTIS CSCL 03B

On April 16, 1969 balloon X-ray observations were taken from Australia (energies above 18 keV). A strong X-ray flux was detected in the range 18 to 36 keV from a source at L(2) = 301+ or − 3 deg, b(2) = −2 + or − 3 deg. During our observations the X-ray flux flared up by about a factor of three. The flare lasted for a period of about one and a half hours. There was also some evidence for a flux change in less than 10 minutes. The average observed flux was about 2 keV/sq cm sec, which was at least a factor of seven higher than that observed about one month earlier on March 20, 1969 at which time no evidence for X-ray emission from that region of the sky was found. The average flux was about as high as that observed on October 15, 1967 from a source at l(2) = 304.8 + or − 1.5 deg., b(2) = -1.5 + or − 2 deg. Author

N71-32380*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TRANSPORT COSMIC RAYS IN THE SOLAR CORONA

L. A. Fisk and K. H. Schatten Aug. 1971 14 p refs Submitted for publication
(NASA-TM-X-65656; X-661-71-313) Avail: NTIS CSCL 03B

The structure of the corona is discussed and mechanisms for the transport of cosmic ray particles in the corona are discussed. It is suggested that there may exist magnetic field gradients, associated with the observed coronal density gradients, to support the pressure differences involved. Changes in the magnetic field can imply the existence of current sheets along which energetic particles can drift at nearly their propagation speed. N.E.N.

N71-32381*# Massachusetts Inst. of Tech., Cambridge. Center for Space Research.
OBSERVATION OF THE ANGULAR MOMENTUM FLUX CARRIED BY THE SOLAR WIND

Alan J. Lazarus and Bruce E. Goldstein Mar. 1971 7 p refs Submitted for publication
(Grant NGR-22-009-372)
(NASA-CR-119682; CSR-P-71-56) Avail: NTIS CSCL 03B

Using data from the Mariner 5 spacecraft, the angular momentum flux carried by the solar wind is measured. It is in agreement with earlier estimates based on observations of the deflection of comet tails. Author

N71-32392*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A NOTE ON LARGE VELOCITY DISCONTINUITIES IN THE SOLAR WIND

L. F. Burlaga Aug. 1971 7 p refs Submitted for publication
(NASA-TM-X-65664; X-692-71-316) Avail: NTIS CSCL 03B

Discontinuity existing in an anisotropic medium is discussed. Discontinuities are shown not to be rotational. The discontinuity predicted has the following characteristics: (1) there is a mass flux through the surface, (2) the density is the same on both sides of the surface, (3) there is a component of magnetic field normal to the surface, and (4) the components are parallel to the surface and sides (1) and (2) are themselves colinear, but different in magnitude. Author

N71-32409*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LIMITS ON THE SMALL SCALE STRUCTURE OF THE DIFFUSE COSMIC X-RAYS

Daniel A. Schwartz, Elihu A. Boldt, Stephen S. Holt, Peter J. Serlemitsos, and R. D. Blasch (Maryland Univ., College Park) Jul. 1971 10 p refs Submitted for publication
(NASA-TM-X-65668; X-661-71-297) Avail: NTIS CSCL 03B

A comparison is made of experimentally measured autocorrelation functions for cosmic X-rays with previous calculations. The experimental measurements verify that X-ray isotropy is not consistent with the observed superclustering, and probably not with clustering galaxies. E.H.W.

N71-32439 Colorado Univ., Boulder.
THE MAGNETIC AND SPECTRAL CHARACTERISTICS OF SMALL H-ALPHA SOLAR PLAGES

Stephen Allan Schoolman (Ph.D. Thesis) 1969 165 p
Avail: Univ. Microfilms Order No. 70-16520

Magnetic fields were measured in 18 small solar plages between June, 1966, and May 1967. The following conclusions were derived from the data: (1) There was often a large inequality in the total flux of each polarity measured in the plage. (2) Plage magnetic fields typically changed by 25 to 60 percent in some parts of the plage, and the total flux changed by as much as 25 percent. (3) The visual appearance of the H-alpha plage corresponded fairly closely to the magnetic outline. (4) Fields of about 50 G were required for active regions filaments to penetrate the optical plage, even though filaments exist in fields of 5 G or less near the plage. Theoretical H-alpha line profiles were produced with a radiative transfer solution using a four level model hydrogen atom in a realistic model atmosphere. The changes in the H-alpha profile which occur in a plage can be best explained by a decreased density (caused by the increased magnetic pressure in the plage) and increased turbulent velocities. Dissert. Abstr.

N71-32512*# California Univ., Berkeley. Space Sciences Lab.
FIVE-MINUTE OSCILLATIONS IN THE SOLAR MAGNETIC FIELD

Andrew S. Tanenbaum, John M. Wilcox, and Robert Howard (Calif. Inst. of Tech., Pasadena) 30 Sep. 1970 20 p refs Presented at IAU Symp. No. 43, Paris, Aug.–Sep. 1970 *Its* Ser. 11, Issue 67
(Grant NGL-05-003-230; Contract N00014-69-A-0200-1016; Grant NSF GA-1319; ONR Proj. NR-021-101)
(NASA-CR-119696) Avail: NTIS CSCL 03B

Evidence for the existence of 5-minute oscillations in the photospheric and low chromospheric magnetic fields is presented, their properties are discussed, and a possible production mechanism is suggested. Author

N71-32528*# Scientific Translation Service, Santa Barbara, Calif.
ON THE NATURE OF SCO XR-1 TYPE X-RAY RADIATION SOURCES [O PRIRODE ISTOCHNIKOV RENTGENOVSKOV O IZLUCHENIYA TIPA SCO XR-1]

I. S. Shklovskiy Washington NASA Aug. 1971 17 p refs Transl. into ENGLISH from Russian rept. Pr-61, 1971 20 p
(Contract NASw-2035)
(NASA-TT-F-13763) Avail: NTIS CSCL 04A

An interpretation is presented of absorption in the soft X-ray region of the spectrum of Sco XR-1 which leads to the conclusion that there is a comparatively cool plasma shell which is situated around the X-ray source. The surface of this shell is responsible for the optical emission of Sco XR-1. The inner part of the source is responsible for X-ray emission. It is shown that if the mass of the nucleus of Sco XR-1 is larger than 0.001m, the hot plasma in its envelope cannot be in hydrostatic equilibrium. The clouds of plasma must move in the vicinity of the nucleus with velocities essentially larger than thermal velocity. Author

N71-32550*# California Univ., Berkeley. Space Sciences Lab.
THE EXTENDED CORONAL MAGNETIC FIELD
John M. Wilcox 16 Oct. 1970 23 p refs Submitted for publication *Its* Ser. 11, Issue 74
(Grant NGL-05-003-230; Contract N00014-69-A-0200-1016; Grant NSF GA-1319; ONR Proj. NR-021-101)
(NASA-CR-119694) Avail: NTIS CSCL 03B

The coronal magnetic field should contain many field lines connecting the photosphere to interplanetary space. A sharp boundary separates two adjacent sectors of opposite polarity. The large-scale structure of the corona is related to the photospheric sector pattern. The corona may frequently contain transient magnetic loops reaching out of five to ten solar radii. Author

N71-32665 Washington State Univ., Pullman.
INTERPRETATION OF COSMIC RADIO NOISE ADSORPTION MEASUREMENTS
Rodney Heisler (Ph.D. Thesis) 1970 91 p
Avail: Univ. Microfilms Order No. 70-16810

A procedure for calculating the cosmic radio noise absorption expected with a given riometer system is presented. The calculations were made from electron density and collision frequency profiles and include the effects of deviative ray paths, different antenna beamwidths in space quadrature, variation of the refractive index with altitude, and ionospheric windowing. The results were compared with riometer measurements taken during solar minimum and maximum periods at Pullman, Washington, in order to establish a better understanding of riometer measurements. For middle latitudes it is found that nearly all of the cosmic noise absorption occurs in the D- and E-layer during solar minimum years. An explanation was presented for the unexpectedly high night-time absorption measured at most riometer stations. The effect of solar radio noise emission during solar maximum years upon riometer absorption measurements was investigated. Dissert. Abstr.

N71-32668 Minnesota Univ., Minneapolis.
A SEARCH FOR HIGH ENERGY GAMMA RAYS FROM THE CYGNUS REGION
Jesusa Villanos Valdez (Ph.D. Thesis) 1969 113 p
Avail: Univ. Microfilms Order No. 70-15829

A nuclear emulsion-spark chamber detector was flown on July 7, 1967 to search for gamma rays (E > 100 MeV) from the Cygnus region. The most likely mechanisms of gamma ray production in Cygnus A were described and it was shown that inverse Compton scattering will be an inefficient process for creating gamma rays of energies > with 100 MeV. The decay of neutral pions arising from nuclear interactions is the most likely source of gamma rays, if any are observed in the future. Possible explanations for the high galactic line emission are also discussed. Dissert. Abstr.

N71-32741# Lockheed Missiles and Space Co., Palo Alto, Calif.
INVESTIGATION OF THE NUCLEAR COMPONENT OF PRIMARY COSMIC RADIATION ON THE SATELLITE KOSMOS-163
M. M. Bredov et al 1971 3 p refs Transl. into ENGLISH from Geomagn. i Aeronom. (USSR), v. 11, no. 2, 1971 p 321–322
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

A telescope, composed of two silicon detectors and three channels, was used on-board the Cosmos 163 to measure the nuclear components of primary cosmic radiation in the Z is > or = 6, domain. The data recorded include nuclear flux magnitude, time intervals, and hardness measurements. The data are in good agreement with previous information. E.H.W.

N71-32789# Academy of Sciences (USSR), Moscow. Inst. for Space Research.
ULTRARELATIVISTIC COSMIC PLASMA
O. F. Prilutskiy, Y. P. Ochelkov, I. L. Rozental, and I. B. Shukalov 1970 46 p refs
(PR-51) Avail: NTIS

The passage of high energy beams through strong magnetic fields is considered. The peculiarity of such a situation consists in the nonlinear interactions between electrons and photons generated by them, and in the variety of elementary processes. The transport equations are derived and are solved for some limit cases. The principal problems of thermodynamic equilibrium at ultrarelativistic temperatures are studied. The ideas developed are illustrated by examples based on the real cosmic objects. ESRO

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N71-31607*# Bendix Corp., Ann Arbor, Mich. Aerospace Systems Div.
DESIGN CERTIFICATION REVIEW, SUPPLEMENT FOR ALSEP ARRAY A-2
Jun. 1971 112 p
(Contract NAS9-5829)
(NASA-CR-115109; BSR-2454A-Suppl) Avail: NTIS CSCL 22A

The design and performance are described of the heat flow experiment, designated Array A2, as part of the Apollo Lunar Surface Experiment Package. The experiment is designed to measure the net outward flux of heat from the moons interior and to provide information on: (1) profile of temperature vs. depth, (2) comparison of moon's interior with earth's mantle, (3) value of thermal parameters in moon's crust, and (4) thermal history of the moon. D.L.G.

N71-31652# Royal Greenwich Observatory, Herstmonceux (England). Time and Latitude Service.
GREENWICH TIME REPORT Quarterly Report, Jul. – Sep. 1970
R. v. d. R. Woolley Sep. 1970 13 p
Avail: NTIS

Results of Greenwich time and latitude observations for time period Jul. – Aug. 1970 are presented. Also included are radio time signals and standard frequency emissions. Author (ESRO)

N71-31795# Oslo Univ. (Norway). Inst. of Theoretical Astrophysics.
THE CHEMICAL COMPOSITION OF THE SOLAR ATMOSPHERE
Oivind Hauge and Oddbjorn Engvold 16 Nov. 1970 34 p refs
(Contract F61052-67-C-0070)
(AD-723633; AFCRL-71-01833 SR-23) Avail: NTIS CSCL 3/2

The present working values of the solar abundances of 65 chemical elements are listed. The abundance of some elements is based on one line only, and the results may be erroneous. A separate list is given showing isotope ratios of eight elements that have been investigated so far. Author (GRA)

N71-31888*# Aerospace Corp., El Segundo, Calif.
PERTURBATION OF GEOS-1 ORBIT BY SOLAR RADIATION PRESSURE

L. Wong and R. Prislin *In* NASA. Goddard Space Flight Center Proc. of the GEOS-2 Program Rev. Meeting, Vol. 4 Nov. 1970 p 1–10 Sponsored by NASA (See N71-31867 19-13)
CSCL 22C

The geometry of solar illumination on the GEOS-I orbit for January 2, 1968 is illustrated. For this date the pertinent parameters for calculating the perturbations due to radiation pressure are given in table form. Author

N71-31869*# Coast and Geodetic Survey, Rockville, Md.
THE ORBIT OF PAGEOS THROUGH MARCH 1970
B. Chovitz and J. Lucas *In* NASA. Goddard Space Flight Center Proc. of the GEOS-2 Program Rev. Meeting, Vol. 4 Nov. 1970 p 11–30 refs (See N71-31867 19-13)
Avail: NTIS CSCL 22C

Pageos has served as a target for concurrent observations by cameras placed at stations in the geometric worldwide satellite triangulation network. To point the cameras correctly, the stations require orbital predictions which must be computed 14 to 21 days in advance. The difficult part of a prediction is the determination of the position of the satellite along its orbit. Because the Earth is rotating, an error of 1 minute in time moves a station about 10 minutes of arc for a station at 45 deg latitude. On a photograph taken by a 450 mm camera, this causes the trail of the satellite to miss the center of the plate by 1.3 mm. For this reason, it is important to obtain the time of the satellite's predicted position to within a few seconds. Author

N71-31870*# London Univ. (England). Mission and Trajectory Analysis Div.
RADIATION PRESSURE EFFECTS ON THE ACCELERATION OF HIGH ALTITUDE BALLOON SATELLITES
David E. Smith and Kenneth H. Fea *In* NASA. Goddard Space Flight Center Proc. of the GEOS-2 Program Rev. Meeting, Vol. 4 Nov. 1970 p 31–56 refs (See N71-31867 19-13)
(X-550-70-92) Avail: NTIS CSCL 22C

The normal method of computing the radiation perturbations assumes the effective shape of the spacecraft to be spherical. An investigation is undertaken to assess the perturbations that may arise when the satellite has an ellipsoidal shape and the radiation scattered by the spacecraft is no longer symmetric about the line joining the satellite and the sun. Consideration is given to both diffuse and specular reflection. It is indicated that a slowly precessing rotation axis might explain the anomalous accelerations found in the earlier studies. Author

N71-32000# Joint Publications Research Service, Washington, D.C.
SOVIET BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 256
15 Jul. 1971 67 p refs Transl. into ENGLISH from various Sino-Soviet Bloc publications
(JPRS-53605) Avail: NTIS

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1. ASTRONOMY p 1–5 refs (See N71-32001 19-30)
2. METEOROLOGY p 6–9 refs (See N71-32002 19-20)
3. OCEANOGRAPHY p 10–14 refs (See N71-32003 19-13)
4. TERRESTRIAL GEOPHYSICS p 15–25 refs (See N71-32004 19-13)
5. UPPER ATMOSPHERE AND SPACE RESEARCH p 26–53 refs (See N71-32005 19-13)
6. SUPPLEMENT: USSR PROPOSES TREATY ON PEACEFUL USE OF THE MOON A. A. Gromyko p 54–61 (See N71-32006 19-34)

N71-32001# Joint Publications Research Service, Washington, D.C.
ASTRONOMY
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 256 15 Jul. 1971 p 1–5 refs (See N71-32000 19-30)
Avail: NTIS

A series of abstracts are presented covering dust in interplanetary space, the upper atmosphere, the earth's atmosphere, and circumterrestrial clouds. Data are covered for the reliability of television motion picture images of celestial bodies, light refraction in the earth's atmosphere, and methods of investigating instability of solar and atmospheric phenomena. Astronomical instruments are also discussed. E.H.W.

N71-32024# Rice Univ., Houston, Tex. Dept. of Space Science.
A SEARCH FOR HIGH ENERGY RADIATION FROM CEN XR-4
F. R. Harden, Jr., W. N. Johnson, III, D. B. Twiag, R. C. Haymes, H. E. Bosch et al [1970] 9 p refs Presented at COSPAR, Leningrad, May 1970 Supported in part by Argentine Air Force Prepared in cooperation with Inst. de Invest. Aeron. y Espaciales and Nacl. Univ. de Tucuman
(Contract F44620-69-C-0083)
(AD-723734) Avail: NTIS CSCL 3/2

A balloon observation of Cen XR-4, a source of celestial z-radiation observed to appear and later decline during 1969 by the Los Alamos group, was conducted from Parana, Argentina on 26 November 1969. The measurements spanned the energy range 30 Kev - 950 Kev. The background at 130,000 feet was found to be only 60% of that measured over Texas. No radiation attributable to Cen XR-4 was detected. The upper limits consequently established are 1.7 x 10 to the minus 5th power protons/sq cm-sec-keV at 511 plus or minus 50 Kev and 8.5 x 10 to the minus 6th power protons/sq cm-sec-keV at energies of 850 plus or minus 70 Kev. These upper limits are incompatible, according to the theory of nucleosynthesis by silicon-burning shells in supernovae, with a supernova less than two megaparsecs distant. Thus the nature of Cen XR-4, which has not been optically identified, remains unknown. Author (GRA)

N71-32160*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SWATHING PATTERNS OF EARTH-SENSING SATELLITES AND THEIR CONTROL BY ORBIT SELECTION AND MODIFICATION
Joseph C. King Dec. 1970 41 p refs
(NASA-TM-X-65627; X-110-70-456) Avail: NTIS CSCL 22C

A generalized investigation of the swathing patterns produced by earth observation satellites in circular, sun-synchronous orbits reveals an extensive array of orbits with interesting and varied pattern-generating properties. The study focuses on repeating type patterns, which occur well distributed over the useful range of orbital altitudes and repeat cycle periods, and in particular on minimum-drift repeating patterns. The latter are regularly distributed around a series of zero-drift altitudes and are advantageous because of their uniform swath progressions and one day intervals between adjacent swaths. A major choice or compromise in pattern selection is between extent of geographic coverage (5 to 100%) and frequency of reobservation of covered areas (1 to 20 days). However, it is possible to modify the swathing patterns of operating satellites by altering their orbits, with a propellant budget probably not exceeding a few percent of the spacecraft weight. Author

N71-32171*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A THREE DIMENSIONAL MODEL OF THERMOSPHERIC DYNAMICS. 3: PLANETARY WAVES

H. Volland (Bonn Univ., West Germany) and H. G. Mayr Jun. 1971 44 p refs Submitted for publication
(NASA-TM-X-65632; X-621-71-242) Avail: NTIS CSCL 03B

The generation and the propagation of atmospheric waves of planetary scale with zonal wave domain numbers n = 1,2,3 and 4 is calculated within the dissipative thermosphere. These waves are generated by solar XUV-heat input and by corpuscular heating of the thermosphere. They contain time independent zonal components, annual and semiannual components. The latitudinal structure of their eigenfunctions and the height variation of this structure is determined. The corresponding wind systems of the various wave modes are determined and compared with observed wind data at mesospheric heights as well as with density data derived from satellite drag observations. It is shown that the predominant annual component with wave number n = 1 is generated by the solar radiative heat input which peaks in the summer hemisphere and that the semiannual component containing in the mesosphere mainly the wave mode of number n = 4 is generated by corpuscular heat input within the auroral ovals. Author

N71-32172*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TRIP TRAJECTORY INTEGRATION PROGRAM
Bernard Kaufman Jun. 1971 101 p refs Submitted for publication
(NASA-TM-X-65635; X-550-71-250) Avail: NTIS CSCL 22C

A numerical integration program (TRIP) based on Encke's method of integrating only the perturbations in the cartesian coordinates is described. The mathematical model can include Venus, Earth, Mars, Jupiter, the Moon and the Sun as either central or disturbing bodies. In addition, full oblateness potentials are included for the Earth and Moon and J sub 2 only for Mars. Modification to expand the oblateness models for the other planets is simple. Solar radiation pressure may also be included as an option in the input. The program uses the latest exported JPL double precision planetary ephemerides (DE 19). TRIP has the option of calculating shadow times using penumbra and umbra; and printout may be obtained at specified times or, in the case of a planetary orbiter, at opoapsis or periapsis. Input data are very simple and there is a variety of coordinate systems for printout. Author

N71-32173*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A COMPARISON OF AN ANALYTICAL AND NUMERICAL SOLUTION OF THE RELATIVE MOTION OF TWO CLOSE SATELLITES OF AN OBLATE PLANET
Richard W. Barbieri and Joel J. Mashbaum Jun. 1971 88 p refs Submitted for publication
(NASA-TM-X-65633; X-551-71-245) Avail: NTIS CSCL 03B

The results of a study undertaken to compare an analytical theory of relative motion with a numerical integration of the equations of planar relative motion are reported. The equations of relative motion were derived from a Lagrangian formulation and numerical integration has been carried out with a program that integrates a system of ordinary differential equations which may or may not be coupled. The analytical solution has been constructed successively in terms of powers of the eccentricity of the reference satellite and powers of a small parameter. The results indicate good agreement, using small initial velocities, over several days for a range of eccentricities. Comparisons are presented to show the effect of including the oblateness of the central body. Results are documented to indicate the dependence of the motion of one satellite about the other upon a variety of initial conditions. Author

N71-32297*# Massachusetts Inst. of Tech., Cambridge. Dept. of Physics.
RAPID FLUCTUATIONS IN THE HIGH-ENERGY X-RAY FLUX FROM A SOURCE IN CRUX
Jeffrey E. McClintock, George R. Ricker, and Walter H. G. Lewin Mar. 1971 11 p refs Sponsored in part by NSF and AEC
(Grant NGL-22-009-015)
(NASA-CR-119686; CSR-P-71-58) Avail: NTIS CSCL 03A

On October 15-16, 1970, balloon X-ray observations from Australia (energies above 15 keV) were made in which a rapidly varying flux was detected from a source at l(2) = 300.7 + or − 0.5, b(2) = −2.2 + or − 2.7 deg. Several flares with rise and decay times of a few minutes were recorded. A flux change of about a factor of five was recorded in 2.5 minutes. The highest flux observed in the energy range from 15-32 keV was approximately 10 keV/sq cm−sec and the lowest, approximately 2 keV/sq cm−sec. A source at l(2) = 303.8 + or − 0.8 deg, b(2) = −1.2 + or − 2.5 deg was also observed. The flux from this source was about 1 keV/sq cm−sec. Author

N71-32298*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
SPACE SHUTTLE GUIDANCE, NAVIGATION AND CONTROL DESIGN EQUATIONS. VOLUME 4: DEORBIT AND ATMOSPHERIC OPERATIONS
K. J. Cox 15 Apr. 1971 49 p ref
(NASA-TM-X-67219; MSC-04217-Vol-4) Avail: NTIS CSCL 22A

The Guidance, Navigation and Control (GN&C) design equations sequencing and interfaces for the computations required in the GN&C Subsystem for deorbit and atmospheric operations phases of the shuttle orbiter flight are defined. All the details necessary to initiate and carry out the design of the required computer modules (subprograms) for the GN&C functions are described in mathematical, logical, and operational language. The detailed equations for the deorbit and entry, transition, cruise and ferry, approach and landing, and horizontal takeoff phases of the Orbiter are presented as well as the equations for communications and pointing functions and the failure detection function. The flow diagrams for the approved equations are included. Author

N71-32323*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OPTIMAL ROUND TRIP SPACE TUG TRAJECTORIES FOR EARTH ESCAPE MISSIONS
Vernon J. Weyers and Fred Teren 19 Aug. 1971 34 p refs Presented at the AIAA Astrodynamics Specialists Conf., Fort Lauderdale, Fla., 17-19 Aug. 1971
(NASA-TM-X-67886) Avail: NTIS CSCL 22A

Optimum round trip trajectories for reusable space tug payload injection missions at energy levels above Earth escape are determined. The variational maximum principle is used to formulate and solve the mathematical problem. Solutions of the resulting two point boundary value problem are obtained by numerical integration and finite difference Newton-Raphson iteration techniques. A method for obtaining approximate solutions of the mathematical problem is also presented. The approximate solutions are much easier to obtain than the exact ones, and the results are in excellent agreement. Details of the mathematical analysis are included. Payload capability is presented as a function of the injection energy. The effects of finite thrust level, vehicle turn-around time, and total trip time are included. Results are shown for various values of stage propellant mass fraction and specific impulse. Characteristics of the optimum trajectories are discussed. Author

N71-32348*# Scientific Translation Service, Santa Barbara, Calif.
LARGE PLANETS [LES PLANETES GEANTES]
S. I. Rasool et al Washington NASA Aug. 1971 29 p refs Transl. into ENGLISH from La Recherche, v. 2, no. 11, Apr. 1971 p 317−325
(Contract NASw-2035)
(NASA-TT-F-13901) Avail: NTIS CSCL 03B

A general review is given of the structures and compositions of Jupiter, Saturn, Uranus, and Neptune. Also included is an outline for the grand tour missions planned for 1977-79. Author

N71-32386*# National Aeronautics and Space Administration, Washington, D.C.
THE PIONEER MISSION TO JUPITER
1971 48 p refs
(NASA-SP-268) Avail: SOD $0.30; NTIS CSCL 22C

Pioneers F and G are being prepared to extend studies of interplanetary phenomena beyond the asteroid belt and fly by Jupiter, the Sun's largest planet. One Pioneer will be launched in 1972 and another in 1973 to go more than eight times as far from the Earth as Mars. Scientific hypotheses about the outer parts of the solar system still differ because few details about them can be learned from observatories on Earth. The great belt of matter that orbits the Sun between Mars and Jupiter will be examined close up for the first time. Author

N71-32388*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SKYLAB THREE-AXIS MOTION PLATFORM TEST RESULTS
Michael T. Borelli and Jack Templeton (Sperry Rand Corp.) 25 Jun. 1971 96 p refs
(NASA-TM-X-64609) Avail: NTIS CSCL 22C

The results of a series of tests conducted on the Skylab three-axis motion platform to establish its performance capabilities are presented. Included in the test series are frequency response, transient response, servosystem stiffness, dynamic position and rate accuracy, friction and stiction, and parameter sensitivity tests. The results pinpoint some of the system's deficiencies and document the nonlinear characteristics of the system. Author

N71-32384 Wisconsin Univ., Madison.
APPLICATIONS FOR BISPECTRAL RADIANCE MEASUREMENTS FROM A SATELLITE
Kirby Julian Hanson (Ph.D. Thesis) 1970 113 p
Avail: Univ. Microfilms Order No. 70-11839 CSCL 03B

The use of Rayleigh scattering as a measure of atmospheric parameters from a geostationary satellite is studied. Two cases are considered: one for clouds with high reflectance; the second for the ocean surface with low reflectance. The objective was to determine cloud top height and total mass above the sea level surface, or sea level pressure. It was shown that with typical instrument performance parameters, the altitude could be determined to 200-ft and sea level pressure to less than 2 mb, providing a large number of measurements were used. It is essential, in surface determination, that no clouds are in the optical path. In addition, the study included means to optimize the instrument performance parameters. Dissert. Abstr.

N71-32389*# Scientific Translation Service, Santa Barbara, Calif.
MYSTERIOUS LUNAR SAMPLES [RAETSELHAFTE MONDPROBEN]
Josef Zaehringer Washington NASA Aug. 1971 36 p refs Transl. into ENGLISH from Max-Planch-Ges. Foerder. Wiss., Jahrbuck 1970 (Munich), p 169-199
(Contract NASw-2035)
(NASA-TT-F-13787) Avail: NTIS CSCL 03B

The samples of lunar material obtained by the Apollo 11 and Apollo 12 space missions are discussed, and the significance of the investigations of these samples for the study of lunar geology and hypothesis of lunar origin is evaluated. The activities of the astronauts on the lunar surface are briefly considered. The lunar samples are described giving attention to minerals also present on earth and to minerals not previously known. The chemical composition of lunar materials is discussed and compared with the composition of terrestrial and meteoritic materials. Searches for superheavy elements and other new elements are reported. Effects of meteorites, cosmic radiation, and solar wind on lunar material are discussed. The determination of the age of lunar materials is considered, and hypotheses of lunar origin are examined. Author

N71-32406*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SIMPLIFIED FORMULAE FOR THE CALCULATION OF PERTURBATIONS OF THE OSCULATING ORBITAL PARAMETERS AND OF THE RANGE RANGE RATE OF A CELESTIAL BODY
R. M. Georgevic 15 Jun. 1971 20 p refs
(Contract NAS7-100)
(NASA-CR-119691; JPL-TM-33-481) Avail: NTIS CSCL 03B

In addition to a concise derivation of the simplest possible group of formulae for the variation of parameters method, the expressions for the disturbing effects on the geocentric range and range rate of a celestial body, due to any disturbing force in the sense of a first-order perturbation theory, are presented. Furthermore, an attempt was made to substitute the mean anomaly as the sixth orbital parameter by a more convenient variable, which asserts the consistency in the orders of magnitude of all six time variations of orbital parameters. Author

N71-32408*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ANALYSIS OF MINITRACK RESIDUALS
B. Rosenbaum Dec. 1970 35 p refs Submitted for publication
(NASA-TM-X-65650; X-551-71-248) Avail: NTIS CSCL 22C

An analysis is given on minitrack residuals for the tracking of GEOS-1. The data stem from previous calculations under the minitrack-optical tracking intercomparison program. An evaluation is given of bias and systematic effects imbedded in the residuals. The treatment of the ionospheric refraction is eased since the tracking observations are during the nighttime and late afternoon and the period is during the minimum of the solar sunspot number. A finding of the analysis is that the direction cosine residuals exhibit a linear bias versus the minitrack angles. The bias parameters are a function of the direction cosine as well as the station and tracking mode. The residual noise is .000085 for which systematic effects are a significant contributing component. We estimate the uncorrelated rms noise to be .00004. This is attributed mainly to instrumental noise of .00002 corresponding to the quantization step for phase difference measurement; and ionospheric refractive noise estimated at .00003 for an ionosphere and elevation angle representative of the test data. At several sites the residual noise is .00005 for either the equatorial or polar tracking mode. Author

N71-32424*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SATURN'S RINGS: A SURVEY
A. F. Cook (Smithsonian Astrophys. Obs.), F. A. Franklin (Smithsonian Astrophys. Obs.), and F. D. Palluconi 15 Jul. 1971 54 p refs
(Contract NAS7-100)
(NASA-CR-119692; JPL-TM-33-488) Avail: NTIS CSCL 03A

Saturn's system of rings is surveyed with emphasis on the establishment of physically reasonable ring models. The dimensions of the planet and principal ring features are determined from published measurements. Photometry of the A and B rings is reviewed, revising some published results, and commenting on derived parameters in light of recent photometry of snow, ice, and other materials. Models for Rings A, B, and C are presented with supporting discussion and consideration is given to the existence of particles closer to the planet than Ring C and further away than Ring A. Author

N71-32517 Florida Univ., Gainesville.
POLARIZATION OF THE DECAMETRIC RADIATION FROM JUPITER
David James Kennedy (Ph.D. Thesis) 1969 141 p
Avail: Univ. Microfilms Order No. 70-14889

Measurements of the two circular polarization components of the decametric radiation from Jupiter have been made at the University of Florida Radio Observatory and at an allied observatory of the University of Chile. Fixed-frequency observations have been made at 10, 16, and 22 MHz, with 60,755 bursts analyzed for the years 1961-68. The time constant of the polarimeter systems used was approximately 0.1 sec. Polarization and intensity characteristics of the radiation have evidenced a marked dependence on both the System 3 longitude of the central meridian and the position of the satellite Io. The usual three sources called A (200 to 300 deg), B (100 to 200 deg), and C (300 to 20 deg) were prominent with the radiation from A and B predominantly RH elliptical. In addition, on the basis of the polarization properties of observed bursts, there was evidence for another LH source, called D, in the range 20 to 100 deg, which became relatively intense at low frequencies. Dissert. Abstr.

N71-32522*# California Univ., Los Angeles.
LUNAR ORBITER SELENODESY STUDIES Final Technical Report
William M. Kaula Jun. 1971 70 p refs
(Contract NSR-05-007-083)
(NASA-CR-119684) Avail: NTIS CSCL 03B

An analysis of lunar orbiter tracking data is presented along with an interpretation of the lunar gravitational field. Numerical error analyses of laser ranging to the moon are also presented. F.O.S.

N71-32651# Pennsylvania State Univ., University Park. Dept. of Astronomy.
THREE MILLIMETER OBSERVATIONS OF THE 7 MARCH 1970 TOTAL SOLAR ECLIPSE
Paul N. Swanson May 1971 46 p refs
(Grant NSF GA-14204)
(SR-022) Avail: NTIS

An accurate radial brightness distribution for the sun at a wavelength of 3.2 mm was obtained from radio telescopic observations of the March 1970 total solar eclipse. The eclipse was observed near Mishuatlan, Mexico under excellent conditions. The recorded curve was corrected for gain and atmospheric effects and reduced to yield a radial brightness curve for the sun. This curve gives the relative brightness to within 10% and has an angular resolution of approximately 5 arc sec. A double peak in the radial brightness distribution was an unexpected result, the probable cause of which appears to lie in the solar atmosphere itself, possibly as a steep temperature gradient or inversion. Further research is necessary, however, to confirm this conclusion. This cannot be conducted until another eclipse observation is made, since no instrument currently exists to measure the required angular resolution of a few seconds of arc. A.C.R.

N71-32654# National Science Foundation, Washington, D.C.
NUMERICAL ANALYSIS OF THE QUADRANGLE ADJUSTMENT OF SATELLITE TRIANGULATION ORGAN PASS-AREQUIPA-CURACAO-JUPITER [NUMERYCZNA ANALIZA WYROWNANIA CZWOROBOKU TRIANGULACJI SATELITRANEJ ORGAN PASS-AREQUIPA-CURACAO-JUPITER]
Karol Minowski 1970 23 p refs Transl. into ENGLISH from Geodezja i Kartografia (Poland), v. 18, no. 2, 1969 p 145–162
(TT-70-55087) Avail: NTIS

The studies of the creation of an East-European satellite triangulation net has not gone as yet beyond the stage of experiments. These experiments tend first of all to establish: (1) the most useful technique of observation and unification of instruments; (2) a uniform photochemical elaboration technique of negatives; (3) optimal methods for obtaining the coordinates of the synchronous moment; and (4) methods of adjustment of the satellite line and net. With 13 point-stations, a large number of observations and time consuming satellite methods the need arises of elaboration of appropriate programs for calculating on electronic brains and compensation of large nets. Author (GRA)

N71-32703 Virginia Univ., Charlottesville.
MODEL ATMOSPHERES AND STRONG-LINE PROFILES FOR LATE-TYPE DWARFS
John Landis Hershey (Ph.D. Thesis) 1969 164 p
Avail: Univ. Microfilms Order No. 70-8074

Nongrey model atmospheres were computed in detail, forming a loose grid ranging from 5200 to 3200 deg in effective temperature. The models used a scaled solar relation, constant radiative flux, or convection effects with constant sum of radiative and convective fluxes. One of each type is metal deficient and one varies surface gravity. From each model twelve strong line profiles were computed in pure absorption. The resulting grids of profiles show that convection has little effect at 5000 deg effective temperature in atmospheres of normal metal composition. At 3200 deg the atmospheres are virtually entirely convective and the resulting profiles differ greatly from a radiative and scaled solar models. Thus only atmospheres including convection should be used for spectral analysis of late K and M dwarfs. The computed profiles from models including convection are much closer to the observed profiles for M dwarfs than the other models. Good agreement of theoretical and observed profiles for subdwarf Grmbr. 1830 suggests that line blanketing is the main problem in spectral analysis of normal K dwarfs. Dissert. Abstr.

N71-32781# California Inst. of Tech., Pasadena, Calif. Owens Valley Radio Observatory.
FLUX DENSITY MEASUREMENTS OF FAINT RADIO SOURCES AT 5 GHz
Gavril Grueff 1971 25 p refs
(Contract N00014-67-A-0094-0019)
(AD-724181; Rept-1971-1) Avail: NTIS CSCL 3/2

Observations of 224 faint radio sources at 5 GHz are reported. The mean spectral index between 408 and 5000 MHz has been computed; according to the sources optical identification, an indication of a correlation between the spectrum shape and the absolute power (or cosmological epoch) has been found for radio galaxies. Author (GRA)

N71-32783# California Inst. of Tech., Pasadena, Calif. Owens Valley Radio Observatory.
AN ABSORPTION-LINE STUDY OF THE GALACTIC NEUTRAL-HYDROGEN AT 21 CM
M. P. Hughes, A. R. Thompson, and R. S. Colvin 1971 84 p refs
(Contract N00014-67-A-0094-0019)
(AD-724182; Rept-1971-2) Avail: NTIS CSCL 3/2

The paper describes observations of galactic 21-cm line absorption in the spectra of ninety-seven radio sources made with the two-element interferometer at the Owens Valley Radio Observatory. Measurements of 21-cm absorption are of fundamental importance because they yield directly information on the optical depth of the galactic hydrogen. Almost all of the many studies of the 21-cm line are concerned with observations in emission, and require assumptions concerning the optical depth before the data can be interpreted in terms of the temperature or columnar density of the gas. GRA

N71-32785# Academy of Sciences (USSR), Moscow. Inst. for Space Research.
SOME PECULIARITIES OF COSMIC DUST DISTRIBUTION
L. W. Leontjev, A. V. Tarasov, and I. A. Terjoshkin 1971 21 p refs
(D-72) Avail: NTIS

An analysis is presented of direct cosmic dust distribution measurements, taking into account the types of sensors used and their calibration conditions and the real operational conditions in space. The consideration of these factors allows for a distribution model which is in good agreement with the data obtained by other methods. ESRO

N71-32787# Academy of Sciences (USSR), Moscow. Inst. for Space Research.
RMS ANGLES OF VENUS SURFACE INCLINATION
N. N. Kroupenio and K. M. Rykunova 1971 26 p refs
(PR-49) Avail: NTIS

The Venus backscattering laws which have been measured with an earth-based radar in cm and dm wavelength ranges are discussed. Using the data on chemical composition, temperature, and pressure altitude profiles which were obtained in the experiments on automatic interplanetary stations "Venera-4", "Venera-5", "Venera-6", and "Venera-7" the radiowave attenuation and refraction in the planetary atmosphere were calculated. This enabled the determination of backscattering laws of Venus surface and the calculation of the surface root-mean-square inclination angles delta sub alpha on the basis of the order of 10 wavelengths within the range of lambda = 3.8 + 70 cm. As lambda increases in this range delta sub alpha decreases from 7.0 to 44 deg. Author (ESRO)

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N71-31602*# TRW Systems Group, Redondo Beach, Calif.
THE EFFECT OF MISSION ATTITUDE TIMELINES ON CONSUMABLES REQUIREMENTS FOR THE PROPOSED SHUTTLE ORBITER HEAT REJECTION SYSTEMS
J. E. Cunningham and C. W. Wurst 30 Jun. 1971 254 p refs
(Contract NAS9-8166)
(NASA-CR-115117; TRW-71-4915-2-014) Avail: NTIS CSCL 22B

A study was conducted to ascertain the consumables requirements of the proposed shuttle orbiter heat rejection systems. The two systems considered require augmentation of the space radiator during peak heat load periods. One system uses H2 supplied from the APS tankage for augmentation. The other system uses an H2O sublimator wherein the H2O is supplied from the water management system. The latter system also uses H2 during selected portions of the missions. The augmentation required is strongly dependent on the attitude of the spacecraft throughout its mission. Accordingly, the study was conducted using generated mission profiles and attitude timelines. Mission profile and attitude timeline data were supplied on magnetic tape. The data reflect four typical shuttle missions. Included are rendezvous, sun synchronous, earth synchronous, and polar orbit missions. The study is preliminary due to the stage of development of the shuttle system. It is, however, unique in application of proposed mission profiles and attitude timelines to a dynamic thermal model in the preliminary design stages. Author

N71-31603*# TRW Systems Group, Redondo Beach, Calif.
APOLLO MISSION J1, CSM 112 CRYOGENIC STORAGE SYSTEM PREFLIGHT PERFORMANCE REPORT
R. K. M. Seto Jul. 1971 65 p refs
(Contract NAS9-8166)
(NASA-CR-115116; TRW-17618-H190-R0-00) Avail: NTIS CSCL 22A

The results of simulations to predict the nominal performance of the cryogenic storage system for Apollo 15 are reported. Assumptions and input data used for simulating the system operation for the nominal mission and anomalies are discussed. F.O.S.

N71-31604*# TRW Systems Group, Redondo Beach, Calif.
ENGINEERING DESCRIPTION FOR TACS-SM RCS CONSUMABLES PROGRAM. PROJECT SKYLAB
T. M. Osmer 1 Jul. 1971 72 p refs
(Contract NAS9-8166)
(NASA-CR-115114; TRW-61-FMT-876; TRW-17618-H175-R0-00) Avail: NTIS CSCL 22B

The Thruster Attitude Control System (TACS) and Service Module Reaction Control System (SM RCS) Consumables Program which generates consumables budgets for the TACS and SM RCS in response to an input mission event is described. The program is designed for use as an aid to preflight mission planning, contingency analyses, and backup SM RCS studies. The program uses previously supplied parametric data from detailed simulations to determine TACS or SM RCS consumption for maneuvers and attitude hold. As such, the program is basically a bookkeeping program and is not an actual simulation of vehicle or hardware performance. The parametric data is stored in the program in the form of polynomial equations with tabularized coefficients which can be easily updated as required. For events not within the range of the stored parametric data, the capability is also included to compute consumables information using theoretical equations. Author

N71-31606*# Aerojet Liquid Rocket Co., Sacramento, Calif.
EXTENDABLE NOZZLES FOR SPACE ENGINES. VOLUME 1: PROGRAM STUDIES Final Report
Nov. 1970 382 p refs
(Contract NAS9-10484)
(NASA-CR-115111; Rept-10484-FR-Vol-1) Avail: NTIS CSCL 22B

The accomplishments in the program to develop extendable-retractable nozzle extensions for space applications are reported. The studies presented include: configuration analysis, hardware design, tradeoffs, technical analysis, and testing. It is concluded that the nozzle extension should be of a radiation cooled design, and the actuator for nozzle deployment and retraction should be electrically powered. F.O.S.

N71-31653# Von Karman Inst. for Fluid Dynamics, Rhode Saint-Genese (Belgium).
RELATIVISTIC ROCKETRY AND THE REQUIREMENTS FOR INTERSTELLAR FLIGHT
K. R. Enkenhus Mar. 1970 86 p refs
(VKI-TN-65) Avail: NTIS

The kinematic requirements for interstellar travel are examined, and the theoretical performance of nuclear and photon rockets is evaluated. Relativistic rocketry, including the problems of time-dilatation in an accelerating system, and the twin paradox are discussed in detail. Formulas and charts are presented which permit a quantitative evaluation of the requirements and possibilities for interstellar flight. It is concluded that, while nuclear rockets are marginal in performance even for flight to the nearest stars, the photon rocket, employing matter-antimatter annihilation reactions, would permit voyages to stars several hundred light years away in the lifetime of the astronaut. Although such flights are

theoretically possible, the engineering problems which must be solved before such flights become a reality are of such a magnitude that it is impossible to predict when interstellar travel will be achieved. Author (ESRO)

N71-32106*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
COMPARISON OF PREDICTED AND MEASURED AERODYNAMICS OF A DELTA BODY ORBITER
John B. McDevitt Aug. 1971 12 p refs
(NASA-TM-X-62046) Avail: NTIS CSCL 22A

The applicability of existing theoretical methods for estimating the hypersonic aerodynamic characteristics of a lifting-body space shuttle orbiter has been studied. The delta-body orbiter proposed by Lockheed (Model LS-200-5) was used in this study. The Hypersonic Arbitrary Body Program (HABP) of Gentry and Smyth was used for estimating the performance of the basic vehicle, and Newtonian and embedded flow concepts were used for estimating control effectiveness. The predicted characteristics were compared with experimental measurements made in the Langley Continuous Flow Hypersonic Tunnel at a free-stream Mach number of 10.4 and in the Ames 3.5-foot hypersonic tunnel at a Mach number of 7.4. In general, the HABP method provided good estimates of aerodynamic characteristics at angles of attack less than about 30 deg but overpredicted somewhat the force coefficients at large angles of attack. The embedded flow approach provided the best estimates of aerodynamic control effectiveness, as expected, although Newtonian estimates were also reasonably accurate. Author

N71-32176*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A CONCEPTUAL STUDY OF A UHF-VHF HYBRID AERONAUTICAL SATELLITE FOR A DELTA LAUNCH VEHICLE
W. N. Redisch, A. F. White, and G. Goldberg Jan. 1971 279 p refs
(NASA-TM-X-65829; X-490-71-77) Avail: NTIS CSCL 22B

The conceptual design and analysis of a geosynchronous equatorial satellite to be used for aeronautical services is presented. The satellite is referred to as a hybrid since it will be capable of communication at either VHF or UHF (L-band) or at both frequency bands simultaneously. The concept studied herein is a momentum wheel stabilized, earth oriented satellite, with UHF, VHF, and C-band earth pointing antennas. The 900-watt satellite is launched on the advanced Thorad-Delta launch vehicle and utilizes an apogee engine to achieve synchronous equatorial orbit. The primary purpose of this study is to determine if a hybrid satellite design which satisfies the assumed stated guidelines is compatible with the Delta launch vehicle capability. Although the spacecraft concept presented appears feasible and compatible with the Delta launch vehicle, there are several disadvantages developed since the concept reflects a high risk design and a minimal eclipse capability. Author

N71-32189*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SERT 2 SPACECRAFT ATTITUDE RESPONSE
Bruce E. LeRoy, John D. Regetz, and Robert R. Lovell Washington Jul. 1971 67 p refs
(NASA-TM-X-2324; E-6218) Avail: NTIS CSCL 22C

Detailed analyses of magnetic, solar pressure, and ion thruster disturbance torques are presented. The attitude responses indicated by linearized equations of motion and a complete simulation of the satellite are compared to flight data. The discrepancies between flight and predicted data are attributed to errors in the estimation of satellite magnetic moments. The use of magnetic moments derived from the flight data resulted in a good correlation. Thrust vector orientation of the ion engines was a potential problem before the flight, so the capability of gimbaling the ion engines was provided. In flight, however, the misalinements were found to be small and no corrections of the thrust vector orientations were made. Author

N71-32372*# McDonnell-Douglas Astronatucs Co., Huntington Beach, Calif.
MSFC-DPD-235/DR NO. SE-07, PHASE B Mass Property Status Report
D. A. Kasulka Jun. 1971 17 p
(Contract NAS8-25140)
(NASA-CR-119899; MDC-G2313) Avail: NTIS CSCL 22B

Mass properties of the space station and logistic module are summarized to permit definition of the discretionary payload margin. Modular weights, center of gravity, moment of inertia, and products of inertia are tabulated for the power, crew, GPL, and logistic module. The total of all launched mass necessary for initial manning plus a 3-man crew is given as 31,589 kg. N.E.N.

N71-32485*# TRW Systems Group, Redondo Beach, Calif.
STUDY OF A COMMON SOLAR-ELECTRIC-PROPULSION UPPER STAGE FOR HIGH-ENERGY UNMANNED MISSIONS. VOLUME 1: SUMMARY Final Report
14 Jul. 1971 73 p refs
(Contract NAS2-6040)
(NASA-CR-114349; TRW-16552-6006-R0-00-Vol-2) Avail: NTIS CSCL 22B

The multimission solar electric stage concept is shown to be a practical, economical, and versatile approach to space exploration. The selected configuration consists of a center body and two rollout solar arrays developing 17.5 kw at 1 AU. The vehicle, launched by a Titan class booster, has an injected mass ranging from 1500 to 2500 kg and carries up to 500 kg of attached or separable payload packages. A large payload stowage volume is provided. High-energy missions to be performed by this stage starting in the mid-70's are those where solar electric power can be used most effectively, namely a Mercury orbiter, a close approach solar probe, asteroid and comet rendezvous missions, and a high-inclination extra-ecliptic probe. Alternate missions to which the stage can be adapted are high-data-rate Mars and Venus orbiters, and outer planet flybys and orbiters. Still more advanced mission such as surface sample return from Mars or the asteroid Eros, and the very difficult rendezvous with Halley's comet in 1986 are also suggested. Author

N71-32486*# TRW Systems Group, Redondo Beach, Calif.
STUDY OF A COMMON SOLAR-ELECTRIC-PROPULSION UPPER STAGE FOR HIGH-ENERGY UNMANNED MISSIONS. VOLUME 2: TECHNICAL Final Report
14 Jul. 1971 374 p refs
(Contract NAS2-6040)
(NASA-CR-114350; TRW-16552-6007-R0-00-Vol-2) Avail: NTIS HC $6.00/MF $0.95 CSCL 22B
For abstract, see N71-32485

N71-32487*# TRW Systems Group, Redondo Beach, Calif.
STUDY OF A COMMON SOLAR-ELECTRIC-PROPULSION UPPER STAGE FOR HIGH-ENERGY UNMANNED MISSIONS. VOLUME 3: APPENDIXES Final Report
14 Jul. 1971 82 p refs
(Contract NAS2-6040)
(NASA-CR-114351; TRW-16552-6008-R0-00-Vol-3) Avail: NTIS CSCL 22B

The appendices presented are on the influence of specific impulse on payload capacity, additional characteristics of nominal mission profiles, analysis of payload loss due to nonoptimal thrust

vector orientation, utilization of earth swingby, additional mission characteristics of an Encke 1980 come redezvous an Eros sample return mission, attitude control subsystem characteristics, and power processor input filter mass. N.E.N.

N71-32496*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ATLAS-CENTAUR AC-19 AND AC-20 PERFORMANCE FOR THE 1969 MARINER MARS MISSIONS
Washington Jul. 1971 164 p refs
(NASA-TM-X-2278; E-6013) Avail: NTIS CSCL 22C

Atlas-Centaur launch vehicles AC-20 and AC-19, using a direct (one burn) mode of ascent, successfully placed Mariners 6 and 7, respectively, into heliocentric transfer trajectories to the planet Mars in 1969. Mariner 6 flew by Mars on an equatorial pass of the planet on July 31, 1969. Five days later, on August 5, Mariner 7 passed by the south pole of the planet Mars. The flight performance of the AC-20 and AC-19 launch vehicles from lift-off through the Centaur maneuvers following spacecraft separation is discussed. Author

N71-32533*# Texas Technological Univ., Lubbock. Dept. of Mathematics.
STATISTICAL DESIGN AND DATA ANALYSIS TECHNIQUES FOR SPACE STATION APPLICATION: AN ESSAY Final Report
T. L. Boullion, H. L. Gary, and P. L. Odell Jun. 1971 168 p refs
(Contract NAS8-26210)
(NASA-CR-118916) Avail: NTIS CSCL 22B

The application of statistical analysis techniques to the selection of experiments for optimum utilization of space stations is discussed. Alternative ways for statistically processing data and alternative ways for statistically designing the experiments can lead to a spectrum of admissible equipment configurations from which an optimal selection may be made. Author

N71-32570*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
USE OF CENTAUR SPACECRAFT FLIGHT DATA IN THE SYNTHESIS OF FORCING FUNCTIONS AT CENTAUR MAIN ENGINE CUTOFF DURING BOOST OF MARINER MARS 1969, OAO 2, AND ATS SPACECRAFT. VOLUME 1: ANALYSIS AND EVALUATION
M. R. Trubert, J. R. Chisholm, and W. H. Gayman 21 Jun. 1971 55 p refs
(Contract NAS7-100)
(NASA-CR-119689; JPL-TM-33-487-Vol-1) Avail: NTIS CSCL 22C

Acceleration flight data of Mariner Mars '69, OAO 2, and ATS spacecraft in the boost phase were used to determine the disturbing forcing function of the Centaur engines at main engine cutoff event. An inverse solution using the concept of Fourier transform and transfer function is presented. Mathematical dynamic models of the spacecraft and the Centaur launch vehicle were derived and Fourier transforms and time histories of the disturbing forcing function were determined. Analysis to determine the response and reaction forces and moments of another spacecraft using the same Centaur vehicle has been derived. Author

N71-32571*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
USE OF CENTAUR SPACECRAFT FLIGHT DATA IN THE SYNTHESIS OF FORCING FUNCTIONS AT CENTAUR MAIN ENGINE CUTOFF DURING BOOST OF MARINER MARS 1969, OAO 2, AND ATS SPACECRAFT. VOLUME 2: COMPUTER PLOTS
M. R. Trubert, J. R. Chisholm, and W. H. Gayman 21 Jun. 1971 85 p
(Contract NAS7-100)
(NASA-CR-119693; JPL-TM-33-487-Vol-2) Avail: NTIS CSCL 22C

Acceleration flight data are plotted for five Centaur main engine cutoff events and selected gimbal axis forcing functions. The Centaur gimbal axis forcing functions for the two Mariner Mars 1969 flights (Mariners 6 and 7), derived from the corresponding field joint acceleration flight data, are presented. Selected components of the forcing functions, derived from acceleration flight data for the OAO 2 and ATS spacecraft, are also given. Author

N71-32661# Lockheed Missiles and Space Co., Palo Alto, Calif.
KOSMOS: SATELLITES OF EARTH, SATELLITES OF SCIENCE
M. Fedorov et al 1971 4 p Transl. into ENGLISH from Avistsiya i Kosmonavtika (USSR), no. 3, 1971 p 36-37
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Cosmos 381 observations on electrical properties in the ionosphere and the onboard instrumentation are described for forecasts of radio communications conditions. The orbit is almost circular at 1000 km, with a 74 deg inclination to the equator. Pulses of 1 sec duration at a number of fixed frequencies in the 2 to 13.4 MHz range are reflected from different ionosphere levels. Other instruments record solar wave radiations between 3 and 1500 A, low frequency radiation, and cosmic rays. Solar cell array, heat regulation system, orientation system, and instrumentation mounting are briefly described. N.E.N.

N71-32680*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
ANALYSES AND LIMITED EVALUATION OF PAYLOAD AND LEGGED LANDING SYSTEM STRUCTURES FOR THE SURVIVABLE SOFT LANDING OF INSTRUMENT PAYLOADS
O. R. Otto, R. M. Laurenson, R. A. Melliere, and R. L. Moore Washington NASA Jul. 1971 490 p refs
(Contract NAS1-8137)
(NASA-CR-111919) Avail: NTIS HC $6.00/MF $0.95 CSCL 22B

Two computer programs developed for the investigation of legged planetary landers were described. Analytical methods incorporated in the programs, operating instructions, and examples of program utilization were presented. One program developed was the Structural Analysis program, containing a center body option, which could be used to analyze a structure by utilizing a finite element idealization. It also contained a landing gear option for determination of the energy absorption and load-stroke characteristics of either a cantilever or inverted tripod landing gear configuration. The second program was the Landing Loads and Motions program, used to predict spatial landing dynamics of a legged lander containing up to five landing gears. This program also contained options for including the effects of a flexible center body and determining lander stability. Several exemplary computer runs were discussed to aid in interpretation of the operating instructions and to illustrate various available program options. Analytical results for several of these cases were compared to test data obtained during model test programs. Author

N71-32790*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INFLUENCE OF BOOM TORSIONAL RIGIDITY AND THERMALLY INDUCED TORSION ON THE STABILITY OF A SEMIPASSIVE GRAVITY-STABILIZED SATELLITE
Vernon K. Merrick and Bruce E. Tinling Washington Aug. 1971 20 p refs
(NASA-TN-D-6481; A-3881) Avail: NTIS CSCL 22B

A semipassive gravity-stabilized satellite was observed to have large and unexpected yaw oscillations. A linearized stability analysis demonstrates that the oscillations may be caused by

thermoelastic torques generated, in a boom, by solar radiation. Thermoelastic torque gradients are influenced by boom twist and by rotation of the entire boom about its axis. Author

N71-32794*# General Electric Co., Schenectady, N.Y. Specialty Fluidics Operation.
FLUIDIC PROPORTIONAL THRUSTER FOR SPARCS 4
T. S. Honda and W. L. Keltz May 1971 40 p
(Contract NAS2-5466)
(NASA-CR-114333; S-71-1084) Avail: NTIS CSCL 22B

The design, development, fabrication, and acceptance test results of two fluidic proportional thrusters for use in the Solar Pointing Aerobee Rocket Control System were presented. A description of the three axis thruster control package utilizing vortex valves for proportional thrust modulation was also presented. The report contained a description of the acceptance procedure followed and the results of hardware evaluation. Author

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N71-31654# Fraunhofer Institut, Freiburg (West Germany).
PRESSURE PULSES IN LAMINATED PLATES [SPANNUNGSSPRUENGE IN STREIFENFOERMIGEN PLATTEN]
Walter Wetzels Feb. 1971 60 p refs In GERMAN
(Rept-2/71) Avail: NTIS

By using a plexiglass rectangular bar and interferometry the propagation of pressure pulses through the bar, generated by a shock tube at one end, is demonstrated. A laser stroboscope is used to record a series of interferograms, and double impulse holography shows additional spatial processes. The difference method is used to solve the exact differential equations with the boundary conditions, and the results compare favorably with the measurements. ESRO

N71-31655# Technische Hochschule, Darmstadt (West Germany). Inst. fuer Statik und Stahlbau.
PAS: A PROGRAMMING LANGUAGE FOR SOLVING STRUCTURAL ANALYSIS PROBLEMS [PAS: EINE PROGRAMMIERSPRACHE FUER AUFGABEN DER STABSTATIK]
K.-H. Moeller, H. Moerchen, and G. Voelkel 1971 62 p refs In GERMAN *Its* Heft No. 14
Avail: NTIS

A problem oriented programming language for the calculation of plane and three-dimensional frames is described. The rules governing the use of the language are outlined, which are very close to the general usage rules in the engineering of structural frames. The frames which can be calculated may have links and may be rigid. ESRO

N71-31699# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
ON THE DETERMINATION OF CONSTITUTIVE EQUATIONS FOR ELASTO-VISCO-PLASTIC MATERIALS [SUR LA DETERMINATION DES LOIS DE COMPORTEMENT DES MATERIAUX ELASTO-VISCO-PLASTIQUES]
Jean Lemaitre (Ph.D. Thesis--Paris Univ., 1971) 1980 147 p refs In FRENCH; ENGLISH summary
(ONERA-Publ-135) Avail: NTIS

A mechanical law of isothermal visco-plastic state, linking the stress, visco-plastic strain and its velocity, is proposed and verified for current stable materials used in mechanical construction. Its extension to the case of back return, to conditions of varying temperature, and to unstable materials is studied. Various theoretical and experimental applications show that in gives an acceptable order of magnitude for the evolutions, with time, of strain or stress associated with any loading and temperature programmes. These results have been generalized to the three dimensional isotropic case under the form of a tensorial differential law, the expression of which is adapted to the structures computing method by network and step by step. An application to the deformation calculation of a thin-walled cylinder subjected to a time-varying complex loading, is completely treated and compared with experiments, for a structure of any shape. A multiple-relaxation device, a creep apparatus, and a traction-torsion-compression high temperature machine are also described. Author (ESRO)

N71-31700# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
STUDY OF STRESSES IN AN AXISYMMETRIC PERFORATED SHELL BY ANALOGY WITH A DISC [CONTRAINTES DANS UNE COQUE DE REVOLUTION TROUEE PAR ANALOGIE AVEC UN DISQUE]
Serge Simiand (Ph.D. Thesis--Paris Univ., 1969) 1970 55 p refs In FRENCH; ENGLISH summary
(ONERA-NT-172) Avail: NTIS

An analogy about stress distribution is set up between an unperforated conical shell and a disc of variable thickness, both subjected to the same stresses. A FORTRAN 2 routine was used to analyze stresses in the shell and to define the equivalent disc. The relevant similarity laws were verified by photoelasticity. This experimental method was subsequently applied to a perforated shell, with the corresponding holes pierced in the disc as well. The results have been experimentally confirmed. Author (ESRO)

N71-31728# Fraunhofer Institut, Freiburg (West Germany).
THE ELASTIC HALF SPACE WITH INSTATIONARY SURFACE LOADING (TWO DIMENSIONAL) PROBLEM [DER ELASTISCHE HALBRAUM BEI INSTATIONAERER BELASTUNG (2-DIMENSIONALES PROBLEM)]
Dieter Coors Apr. 1970 101 p refs In GERMAN
(Rept-4/70) Avail: NTIS

A new method is developed for the solution of the dynamic two dimensional problem of the elastic wave propagation resulting from surface loads in an elastic half space. The a priori assumption is, that the body is originally at rest and that boundary conditions at the surface result in two functions linearly dependent on dilatation, rotation, displacement, and stresses. Author (ESRO)

N71-31755# Illinois Univ., Urbana. Dept. of Civil Engineering.
APPROXIMATE DETERMINATION OF STRESSES NEAR NOTCHES AND CORNERS IN ELASTIC MEDIA BY AN INTEGRAL EQUATION METHOD
Martin R. Barone and Arthur R. Robinson Mar. 1971 123 p refs *Its* Struct. Res. Ser. No. 374
(Contract N00014-67-A-0305-0010)
(AD-723537; UILU-ENG-71-2009) Avail: NTIS CSCL 20/11

A numerical method for determining stresses near corners and cracks in two-dimensional elastic bodies is presented. The method is based on an integral equation formulation which uses the character of the displacements near such irregular boundary points. Kernels for the integral equations at points along smooth portions of the boundary are obtained from the solutions to concentrated force problems in the usual manner. The most significant part of the study consists of the development of convenient new kernels

for the integral equations written at the irregular boundary points. Suitable numerical techniques are used to convert the set of integral equations to a set of linear algebraic equations which involve the boundary values as unknowns. Accurate results are obtained for three sample problems using a relatively small number of simultaneous equations. Moreover, the results are stable with respect to the number and distribution of boundary points. Author (GRA)

N71-31765# Army Cold Regions Research and Engineering Lab., Hanover, N.H.

ACTION OF ICE ON ENGINEERING STRUCTURES

K. N. Korzhavin [1971] 321 p refs Transl. into ENGLISH of the publ. 'Vozdiestvie Lda na Inzhenernye Sooruzheniia' Izd Sibirsk. Otd. Akad. Nauk SSSR, 1962 p 1-270

(AD-723169) Avail: NTIS HC$6.00/MF$0.95 CSCL 8/12

Contents: Nature of interaction of ice and structures; Survey of physico-mechanical properties of river ice; Pressure of ice on structural abutments (supports); Pressure of ice on structures of considerable extent, and other cases; Natural methods of determining ice pressure on structural supports; Experience gained in determining actual pressure of ice on structures by use of kinematic method; Passage of ice and size of ice-admitting openings; Findings and conclusions. GRA

N71-31778# Air Force Systems Command, Wright-Patterson AFB, Ohio. Materials Lab.

AN APPLICATION OF FRACTURE CONCEPTS TO THE PREDICTION OF CRITICAL LENGTH OF FATIGUE CRACKS. PART 4: FRACTURE MECHANICS ANALYSES FOR PREDICTION OF CRITICAL LENGTHS AND VELOCITIES OF FATIGUE CRACKS IN 7075-T7351 ALUMINUM ALLOY Technical Report, Jun. 1969-Jun. 1970

Sidney O. Davis (M.S. Thesis) Mar. 1971 64 p refs

(AD-723285; AFML-TR-70-202-Pt-4) Avail: NTIS CSCL 20/11

The Irwin fracture criteria and Boyle mechanical compliance analysis were used to predict critical crack lengths of stable fatigue cracks in aluminum alloy (7075-T7351) plates. The Boyd hypothesis was also used to predict the velocity of unstable cracks in these plates. Author (GRA)

N71-31800# Air Force Systems Command, Wright-Patterson AFB, Ohio. Air Force Materials Lab.

FOURIER ANALYSIS OF CLAMPED ANISOTROPIC PLATES Technical Report, Jan.-Aug. 1970

James M. Whitney Feb. 1971 26 p refs

(AD-723287; AFML-TR-70-281) Avail: NTIS CSCL 20/11

Using a Fourier series method, a solution is obtained to the governing equations of a homogeneous, or symmetrically laminated, anisotropic, rectangular plate with clamped edges. Solutions are obtained for bending under transverse load, buckling under combinations of uniform shear and biaxial compression, and natural frequencies of flexural vibrations. Numerical results are compared to those previously obtained by the Ritz method. Author (GRA)

N71-31806# North Carolina State Univ., Raleigh. Center for Acoustical Studies.

A FORTRAN MODEL FOR PREDICTING THE RESPONSE OF THE CLASS 1 FLEXTENSIONAL UNDERWATER ACOUSTIC TRANSDUCER SHELL TO AN N SHAPED SHOCK PULSE

Prakash Dhirubhai Desai and Larry H. Royster Feb. 1971 26 p refs

(Contract Nonr-486(11))

(AD-723826; TR-14) Avail: NTIS CSCL 17/1

A Fortran program to compute the dynamic response of a variable cross section curved beam with horizontally guided ends and end masses to an N shaped shock pulse is presented. The program also obtains the eigenvectors, natural frequencies of vibrations, and static deflection of the beam. Author (GRA)

N71-31816# Technische Hochschule, Darmstadt (West Germany). Inst. fuer Statik und Stahlbau.

CONTRIBUTION TO THE LATERAL STABILITY OF PLANE FRAMEWORKS WITH TWO CHORDS AND ARBITRARY LATERAL SUPPORTS OR OF I GIRDERS WITH DEFORMABLE CROSS SECTION [BEITRAG ZUR BERECHNUNG DER STABILITAET BELIEBIG GELAGERTER ZWEIGURTIGER FACHWERKTRAEGER ODER VOLLWANDTRAEGER MIT QUERSCHNITTSVERFORMUNG GEGEN AUSWEICHEN AUS DER TRAGWERKSEBENE]

K. Kloeppel, H. Friemann, and D. Reuschling 1969 79 p refs In GERMAN *Its* Heft No. 8

Avail: NTIS

The general buckling case of trusses under lateral deformation is treated. No limitations are given in relation to geometry, truss form, and truss supports. The cross section dimensions and normal forces are assumed to be constant per beam, but variable over the truss. Using computer programs, the U-type bridge problem and the buckling of double trusses is calculated. ESRO

N71-31919# Svenska Kullagerfabriken Staal, Hofors (Sweden).

EFFECT OF SULPHIDE ON THE ENDURANCE OF BALL BEARINGS

S. Baeckstroem *In* Roy. Swed. Acad. of Eng. Sci. Clean Steel, Vol. 1 1971 p 170-177 refs (See N71-31901 19-17)

Avail: NTIS

Endurance data obtained on ball bearing steels (1% C, 1.5% Cr) of different sulfur content are reviewed. The test results show that the endurance is independent of the sulfur content. ESRO

N71-31944# Naval Research Lab., Washington, D.C. Ocean Materials Criteria Branch.

THE USE OF ULTRASONIC SURFACE WAVES TO EVALUATE MAGNETIC INDICATIONS OF SUBSURFACE DEFECTS

Stephen D. Hart Apr. 1971 18 p refs

(AD-723526; NRL-MR-2236) Avail: NTIS CSCL 14/2

An ultrasonic technique for detecting flaws near the surface in plate material has been developed. The technique makes use of pulsed surface waves in a two transducer pitch-catch arrangement. This provides greater sensitivity than a single transducer pulse-echo system. The system is used to evaluate magnetic particle indications of near-surface flaws. Author (GRA)

N71-31948# Naval Research Lab., Washington, D.C.

INTEGRATION OF ANALYTICAL PROCEDURES FOR FRACTURE-SAFE DESIGN OF METAL STRUCTURES Summary Report

W. S. Pellini 26 Mar. 1971 70 p refs

(AD-723190; NRL-7251) Avail: NTIS CSCL 13/13

An interpretive review is presented of the development of scientific knowledge of fracture processes and of the technological application of this information to the evolution of rational engineering principles for fracture-safe design. Discussions of mechanical, metallurgical, and structural aspects of the subject emphasize that engineering design practices must involve detailed consideration of all factors. The evolution of modern fracture-safe design practices began in 1950. The results of the earlier research provided a base from which definitive studies were evolved. The development of significant fracture-characterization test methods and of procedures for their analytical interpretation paced the rate of progress during this time period. A description is provided of

fracture tests which are suitable for evolving data-bank references of metal properties, required for general engineering practice of fracture-safe design. Major emphasis is placed on procedures based on the use of analysis diagrams, which provide for cross-referencing between structural factors and metal properties. The primary aim of the text is to present the case for the utilization of modern practices in the design of engineering structures. Author (GRA)

N71-31989# Cornell Univ., Ithaca, N.Y. Dept. of Theoretical and Applied Mechanics.
TEMPERATURE AND DEFORMATIONS IN RODS AND PLATES MELTING UNDER INTERNAL HEAT GENERATION
Bruno A. Boley Mar. 1971 22 p refs
(Contract N00014-67-A-0077-0009)
(AD-723199; TR-4) Avail: NTIS CSCL 18/10

Some basic problems concerning melting plates under conditions which may be expected in nuclear reactors are considered. These include the development of an exact analytical solution for a plate melting under the action of internal heat generation, an outline of an approximate solution for the same problem, an estimate of the time required for total melting and the construction of a lower bound for that time. The defromations of the melting plate are then treated, and the accuracy of the use of a purely elastic analysis is assessed. Author (GRA)

N71-32025# Air Force Systems Command, Wright-Patterson AFB, Ohio. Flight Dynamics Lab.
A GENERAL FATIGUE PREDICTION METHOD BASED ON NEUBER NOTCH STRESSES AND STRAINS Final Report
John M. Potter Feb. 1971 35 p refs
(AD-723631; AFFDL-TR-70-161) Avail: NTIS CSCL 20/11

A new combination of the Neuber parameter and stress-strain data is proposed and investigated for a completely general graphic analysis of cycle-by-cycle notch stress level. The proposed analysis is applied to two common aircraft structural materials, 2024-T4 and 7075-T6. Life to failure predictions based on the graphically derived notch stress levels compare very favorably with constant stress amplitude notched coupon results. Author (GRA)

N71-32026# Catholic Univ. of America, Washington, D.C. Dept. of Civil and Mechanical Engineering.
COMPENDIUM OF STRUCTURAL MECHANICS COMPUTER PROGRAMS
Nicholas Perrone Apr. 1971 330 p
(Contract N00014-67-A-0377-0011)
(AD-723178) Avail: NTIS HC $6.00/MF $0.95 CSCL 20/11

Information is gathered on more than 400 computer programs in structural mechanics. Program descriptions are filed in a simple subject format in a fairly precise sub-discipline of structural mechanics. This compilation should provide the structural mechanics community not only with information concerning the programs available but also with identification of those groups most active in specific fields of interest. Author (GRA)

N71-32027# Catholic Univ. of America, Washington, D.C.
LARGE DEFLECTIONS OF FLAT ARBITRARY MEMBRANES
Robert Kao and Nicholas Perrone Feb. 1971 26 p refs
(Contract N00014-67-A-0337-0011; NSF GK-23747)
(AD-723538) Avail: NTIS CSCL 20/11

Displacement equations in Cartesian coordinates are solved to determine the large deflection response of flat membranes. Cases included are circular, rectangular, and polygonal membranes. For the last two cases an added complication is also treated consisting of a rigid central core region. The nonlinear relaxation method in conjunction with finite difference approximation is utilized to solve the governing differential equations. Comparisons, where possible, with other solutions are quite favorable. For rectangular membranes results are put in a form convenient for direct engineering use. Author (GRA)

N71-32028# Massachusetts Inst. of Tech., Cambridge. Dept. of Naval Architecture and Marine Engineering.
THE DYNAMIC PLASTIC BEHAVIOR OF SHELLS
Norman Jones, J. W. Dumas, J. G. Giannotti, and K. E. Grassit Apr. 1971 66 p refs
(Contract N00014-67-A-0204-0032)
(AD-723831; Rept-71-6) Avail: NTIS CSCL 13/13

A survey has been made of the literature published previously on the inelastic behavior of shells subjected to dynamic loads. An experimental investigation has also been undertaken to examine the behavior of various cylindrical shell panels which were loaded with an impulse on the inner surface. The panels were fully clamped along the two longitudinal edges and free on the other two. The initial kinetic energy of the dynamic loads was sufficiently large to cause inelastic behavior and to produce maximum permanent transverse deflections of up to nearly twice the corresponding panel thickness. Tests were conducted on mild steel and aluminum 6061 T6 panels which had various thicknesses and an included angle of 90 degrees approximately. Author (GRA)

N71-32168*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TORSIONAL MEASUREMENTS OF SATELLITE BOOMS
Richard A. Abercrombie Washington Aug. 1971 43 p refs
(NASA-TN-D-6175; G-1018) Avail: NTIS CSCL 22B

The experimentally determined torsional parameters of several different satellite booms currently in use are presented. Included is a detailed description of the procedure used in making these measurements along with the test data and the resultant graphs. Also described is a device that has been developed to measure and plot the torsional characteristics of booms. Author

N71-32229*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CRACK SHAPES AND STRESS INTENSITY FACTORS FOR EDGE-CRACKED SPECIMENS
Thomas W. Orange 1971 8 p refs Presented at 5th Natl. Symp. on Fracture Mech., Champaign, Ill., 31 Aug.–2 Sep. 1971
(NASA-TM-X-67891; E-6249) Avail: NTIS CSCL 20K

A simple stress intensity factor expression is given for a deep edge crack in a plate in tension. The shapes of cracks opened by tension or bending are approximated by conic sections, and the conic section coefficients related to plate geometry by very simple empirical equations. The magnitude of the crack displacement is a function of applied load, plate geometry, and the elastic constants of the plate material. The shape of a loaded crack in a semi-infinite plate is, approximately, a portion of an ellipse whose semimajor axis is about three times the crack length. As the crack length (relative to the plate width) increases, the crack shape becomes parabolic, then hyperbolic, the acuity of the hyperbola increasing with the relative crack length. Author

N71-32243*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio.
DESIGNING FOR IMPACT RESISTANCE WITH UNIDIRECTIONAL FIBER COMPOSITES
Christos C. Chamis, Morgan P. Hanson, and Tito T. Serafini Washington Aug. 1971 42 p refs
(NASA-TN-D-6463; E-6254) Avail: NTIS CSCL 11D

Composite micromechanics and macromechanics and the miniature Izod impact test were used to investigate the impact resistance of unidirectional composites. Several composite systems were examined both theoretically and experimentally. The

composites are classified theoretically relative to their impact resistance for longitudinal, transverse, and shear modes. Experimental results are reported only for Izod impact with the fibers either parallel or transverse to the cantilever longitudinal axis. Impact resistance design criteria which evolved during the investigation were used to design hybrid composites with improved impact resistance. This was illustrated theoretically and demonstrated experimentally. Approximate design procedures using the impact factor are described. The results show that in-situ fiber and matrix elongation-to-fracture, matrix modulus, fabrication process, fiber and void volume ratios, and microresidual stresses are variables which affect the impact resistance. The ranking of composite impact resistance on the basis of measured and predicted results was in excellent agreement. Author

N71-32303*# LTV Aerospace Corp., Dallas, Tex. Vought Missiles and Space Div.

GEOMETRIC, AERODYNAMIC, AND KINEMATIC CHARACTERISTICS OF TWO TWIN KEEL PARAWINGS DURING DEPLOYMENT

Paul M. Kenner, Frederic T. Churchill, and Ralph B. Holt Washington NASA Aug. 1971 69 p refs

(Contract NAS1-6957)

(NASA-CR-1788) Avail: NTIS CSCL 01B

The results are presented of an analysis of flight test data on two intermediate size (5000 lb payload) twin keel parawings. Kinematic data on various points on each canopy were determined along with establishing forces for two stages of inflation. Transient aerodynamics produced pressure differentials as high as five times the dynamic pressure of the free stream. Local structural failures are attributed to impulsive arresting of spanwise expansion and abrupt reversals in curvature during chordwise expansion. Author

N71-32306*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

AN IMPROVED METHOD OF COLLOCATION FOR THE STRESS ANALYSIS OF CRACKED PLATES WITH VARIOUS SHAPED BOUNDARIES

J. C. Newman, Jr. Washington Aug. 1971 46 p refs

(NASA-TN-D-6376; L-6996) Avail: NTIS CSCL 20K

An improved method of boundary collocation was developed and applied to the two-dimensional stress analysis of cracks emanating from, or in the vicinity of, holes or boundaries of various shapes. The solutions, presented in terms of the stress intensity factor, were based on the complex variable method of Muskhelishvili and a modified boundary collocation method. The complex-series stress functions developed for simply and multiply connected regions containing cracks were constructed so that the boundary conditions on the crack surfaces are satisfied exactly. The conditions on the other boundaries were satisfied approximately by the modified collocation method. This improved method gave more rapid numerical convergence than other collocation techniques investigated. Author

N71-32324*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

TORSIONAL SHEAR STRENGTH OF FILAMENT-WOUND GLASS-EPOXY TUBES

L. David Wall, Jr. and Michael F. Card Washington Aug. 1971 47 p refs

(NASA-TN-D-6140; L-7058) Avail: NTIS CSCL 20K

Results are presented from torsion tests conducted on 36 multilayered, filament wound, glass epoxy tubes. Configurations with helical windings and with alternating helical and circumferential windings were investigated for various winding angles. Under small loadings, shear moduli deduced from linear shear stress-strain curves were found to be in reasonable agreement with analytical predictions. Under larger loadings, various degrees of nonlinearity in shear stress-strain curves were encountered, depending on the helical winding angle. Experimental torsional strengths were defined by a 0.2-percent offset yield stress or by maximum stress when large nonlinearities did not exist. These strengths were compared with torsional buckling predictions for orthotropic cylinders, and with material strength predictions based on orthotropic yield criteria and elastic stress analysis. Computed elastic buckling stresses were considerably higher than the experimental strengths for most of the test specimens except for those with only 30 deg and 45 deg windings. Experimental torsional strengths were found to correlate with conventional yield predictions if predicted yielding in certain layers were ignored or if unrealistically large transverse tensile and shear strengths of unidirectional laminae were employed in the analysis. Author

N71-32336# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

STABILITY OF A CIRCULAR CYLINDRICAL SANDWICH SHELL REINFORCED BY LATERAL RING-TYPE DIAPHRAGMS

B. P. Chernov 29 Jan. 1971 21 p refs Transl. into ENGLISH from Tr. Korablestroitelnyi Inst. (Leningrad), no. 54, 1967 p 129–140

(AD-723548; FTD-HT-23-24-71) Avail: NTIS CSCL 13/13

Equations of equilibrium in displacements are obtained for a shallow sandwich shell of asymmetrical construction with isotropic face layers and light-weight core; the equations are reduced to two equations in terms of a force function and deflection for the case of an isotropic core, and are supplemented by the projections of tangential stresses in the prebuckling state. Differential equations of the complex flexure of a reinforcing diaphragm are discussed. The procedure of deriving an equation for determining the buckling load of a circular cylinder of symmetrical sandwich construction under omnidirectional normal pressure is outlined. GRA

N71-32373*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

SUPERSONIC FLUTTER OF SANDWICH PANELS: EFFECTS OF FACE SHEET BENDING STIFFNESS, ROTARY INERTIA, AND ORTHOTROPIC CORE SHEAR STIFFNESSES

Larry L. Erickson (Ph.D. Thesis – Va. Polytechnic Inst.) Washington Jul. 1971 134 p refs

(NASA-TN-D-6427; A-3868) Avail: NTIS CSCL 20K

A theoretical analysis is presented for the supersonic flutter of flat rectangular, biaxially stressed sandwich panels. The mathematical model describing the panel motion includes terms that account for rotary inertia, face sheet bending deformations, and transverse shear deformations of an orthotropic core such as honeycomb. Numerical results show that the face sheet bending stiffness has a negligible effect on flutter if the faces are thin compared to the core thickness. The frequency coalescence behavior can be markedly changed by the combined effects of rotary inertia and core shear flexibility. Rotary inertia also causes the flutter solution to depend slightly on the crossflow in-plane loading. The directional shear stiffness properties of the core are of comparable importance for square panels. As the panel width increases, the importance of the shear stiffness in the crossflow direction decreases. Author

N71-32412 National Lending Library for Science and Technology, Boston Spa (England).

BEHAVIOUR OF CYLINDRICAL VESSELS UNDER INTERNAL PRESSURE AT HIGH TEMPERATURES

K. Wellinger et al 5 Oct. 1970 20 p Transl. into ENGLISH from Brennstoff-Waerme-Kraft (Duesseldorf), v. 21, no. 9, Aug. 1969 p 395–400

(NLL-CE-Trans-5321-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The strength behavior of cylindrical vessels under internal pressure and at high temperatures is investigated. Tests were conducted on tubes and hollow cylinders at room and at temperatures up to 600 C, to determine failure creep, and fatigue under pulsating internal pressure. The tubes and cylinders tested were made of steel 35.8, 15 Mo3, 13 CrMo 44 and 10 CrMo 910 with diameter ratios from 1.46 to 3.0. For a cylindrical vessel of steel 35.8 the tensile strength at elevated temperatures and the temperature at the maximum internal pressure in rapture tests can be calculated from the diameter ratio. Stress-loading time curves obtained from static and pulsating load tests for various temperatures are compared. Author

N71-32416# Franklin Inst., Philadelphia, Pa. Research Labs.
PROCEEDINGS OF THE WORKING CONFERENCE ON THRAUSTICS, PART 1 Final Scientific Report
Gunther Cohn, Francis W. Cooke, Gilbert J. London, and Melvin B. Zisfein Dec. 1970 369 p refs Conf. held at Philadelphia, 9-13 Dec. 1968
(Contract F44620-68-C-0068)
(AD-722854; FIRL-F-C2231-Pt-1- AFOSR-70-2863TR-Pt-1) Avail: NTIS CSCL 13/13

The report describes the genesis and development of the emerging field of thraustics, the technology of using high-performance materials of limited ductility in load-bearing, structural applications. Included are the papers presented, the nine major recommendations of the conference, background material, a history of the thraustics effort, and interpretative discussions of the recommendations. Author (GRA)

N71-32452*# Translation Consultants, Ltd., Arlington, Va.
AEROELASTIC STABILITY OF PLANE SANDWICH-TYPE STRUCTURES PLACED IN A CURRENT OF SUPERSONIC GAS [STABILITATEA AEROELEASTICA A STRUCTURILOR PLANE DE TIP SANDVIS, PLASATE INTR-UN CURENT DE GAZ SUPERSONIC]
L. Librescu et al Washington NASA Aug. 1971 30 p refs Transl. into ENGLISH from Stud. Cercet. Mec. Apl. (Romania), v. 30, no. 1, 1971 p 171-196
(Contract NASw-2038)
(NASA-TT-F-13778) Avail: NTIS CSCL 01B

Particular attention is devoted to the problem of the aeroelastic stability of infinite sandwich panels. The influence of the parameter which expresses the flexibility of the transverse shear of the structure and the parameter connected with the axial loads on the critical magnitudes (flutter and divergence) is investigated. The conclusions reached in other recent works regarding the lack of agreement between a series of results in this field obtained in exact and approximate fashion are examined and justified. Author

N71-32488*# General Applied Science Labs., Inc., Westbury, N.Y.
EXPERIMENTAL DETERMINATION OF ACOUSTIC AND STRUCTURAL BEHAVIOR OF WALL PANEL-CAVITY CONFIGURATIONS EXPOSED TO SONIC BOOMS
W. Peschke, E. Sanlorenzo, and M. Abele [1970] 133 p refs
(Contract NAS1-9594)
(NASA-CR-111925; GASL-TR-754) Avail: NTIS CSCL 20K

The structural response and acoustic transmission characteristics of a 6.25 ft × 10.42 ft, 1/4-inch thick glass pane and two 8 ft × 12 ft standard wood frame construction wall panels acted upon by a sonic boom N-wave were investigated. The use of a variable-volume cavity in conjunction with the test panels provided data concerning the acoustic properties of the cavity and, for a limited range of cavity volumes, the influence of the cavity on the behavior of the glass pane. The results indicate that the initial glass pane acceleration and cavity pressure amplitude are essentially independent of the N-wave duration. Although the initial acceleration of the pane is practically constant as the cavity volume increases, the initial pressure is directly proportional to the variation in stiffness ratio. The duration which induces maximum dynamic and acoustic effects in the glass pane and cavity is approximately 60 ms., and the dominant modes excited in the glass pane are the (1,1), (2,1), (3,1), and (4,1) corresponding to frequencies of 7, 10, 14, and 40 Hz. Author

N71-32514 Illinois Inst. of Tech., Chicago.
EXPERIMENTAL STUDIES OF ELASTIC STRESS WAVE PROPAGATION
David Lewis, III (Ph.D. Thesis) 1970 217 p
Avail: Univ. Microfilms Order No. 70-17252

Presented is an experimental study of an elastic wave propagation problem, and the development of an optical bench incorporating a pulsed ruby laser light source, polariscope, and interferometer. The wave propagation study treated the propagation of two-dimensional Rayleigh waves in elastic wedges. The propagation of the Raleigh waves past the corner of the wedge was characterized by four dimensionless transmission and reflection coefficients. Dynamic photoelasticity was used to study wave propagation in thin plate, epoxy wedge models. The results obtained differed substantially from the first-order theoretical results available for comparison. Good agreement was obtained with other theoretical results. The development of the optical bench employing a pulsed ruby laser light source was prompted by the limitations of the multiple spark camera presently being employed in a dynamic polariscope. Dissert. Abstr.

N71-32554*# Translation Consultants, Ltd., Arlington, Va.
THERMALLY INDUCED ELASTIC STRESSES AND THEIR EFFECT ON CRACK FORMATION AND PROPAGATION [THERMISCH INDUZIERTE ELASTISCHE SPANNUNGEN UND IHR EINFLUSS AUF AUFLOESUNG UND AUSBREITUNG VON BRUECHEN]
J. G. Blauel Washington NASA Aug. 1971 121 p refs Transl. into ENGLISH from German rept. 5/70, Jul. 1970 141 p
(Contract NASw-2038)
(NASA-TT-F-13699) Avail: NTIS CSCL 20K

Stress conditions and behavior of materials with sharp cracklike grooves subjected to thermal and mechanical loads were studied. Flat plates of transparent, linearly elastic mirror glass were used for fracture mechanics, stress field (interferometry), and rupture (ultrasonic fractography) analyses. Author

N71-32804# Scientific Translation Service, Ann Arbor, Mich.
DIAGRAMS FOR THE DETERMINATION OF THE RISK OF FAILURE OF STRUCTURES
Caterina Manuzio [1970] 15 p Transl. into ENGLISH from Ann. Inst. Tech. Batiment Trav. Publ. (Paris), v. 22, 1969 p 249-257
Prepared for Oak Ridge Natl. Lab.
(ORNL-TR-2133) Avail: NTIS

The risk of structural failures is defined and techniques for determining risk of structural failure diagrams are given. Expressions of random variables in reduced units according to the Gauss and extreme value laws and formulas for diagram calculation and approximation are included. Risk of failure as a function of the ratio between the central strength and load values is discussed. J.M.

N71-32860 National Lending Library for Science and Technology, Boston Spa (England).
APPLICATION OF FRACTURE MECHANICS AND INSTRUMENTED NOTCHED BAR IMPACT TESTS TO DETERMINE THE BRITTLE BEHAVIOUR OF STEELS
E. Schmidtmann et al 2 Feb. 1971 19 p refs Transl. into ENGLISH from Materialpruefung (Duesseldorf), v. 12, no. 17, 1970 p 221-228

(NLL-RISLEY-Trans-2073-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The brittle behavior of high strength steel was investigated by application of fracture and instrumented notched-bar impact tests over a range of transition temperatures and stress conditions. Specifically, the effect of temperature on the stress factor (K), on the width of the crack opening, and on the transition from plane strain to plane stress was examined. The influence of structural anisotropy on results of crack expansion experiments and on the transition temperatures in the notch-impact tests was also determined. It was found that changes in heat treatment affect the K-temperature curve and the values of the transition temperature for high strength water-quenched steel. A.C.R.

N71-32695*# Goodyear Aerospace Corp., Akron, Ohio.
THERMAL AND STRESS ANALYSIS OF AN ATTACHED INFLATABLE DECELERATOR (AID) DEPLOYED IN THE MARS AND EARTH ATMOSPHERES
G. L. Faurdte and J. L. Burgess 12 Aug. 1971 108 p refs
(Contract NAS1-9726)
(NASA-CR-111920; GER-14939) Avail: NTIS CSCL 20M

Parametric thermal and stress analyses of a 20-ft-diameter Attached Inflatable Decelerator (AID) deployed in the most severe of the postulated Mars atmospheres were conducted. A posigrade equatorial ballistic entry was considered from an altitude of 800,000 ft, at an inertial velocity of 15,000 fps, and a flight path angle of −18 deg. AID deployment was considered over a Mach number range of 3.0 to 8.0 for ballistic entry coefficients 0.4, 0.5, 0.6, and 0.7 slugs/sq ft. Deployment of the AID was shown to be feasible and the minimum coating weight (1.0 oz/sq yd) needed to provide an air tight fabric structure was shown to provide thermal protection for the fabric over the entire range of entry ballistic coefficients considered for deployment Mach numbers up to 6.7. In addition to the Mars entry study, a thermal and stress analysis of an AID deployed in the Earth atmosphere was conducted to determine a limiting state-of-the-art design point. Author

N71-32704 New York Univ., N.Y.
SOME PROBLEMS IN THE NON-LINEAR THEORY OF PLATES
Hugo Carlos Folguera (Ph.D. Thesis) 1969 112 p
Avail: Univ. Microfilms Order No. 70-16058

The nonlinear oscillations of circular plates loaded with a radial pressure applied at their edges and under the assumption that the deformations are radially symmetric, are considered. The Von Karman – Foppl equations serve as a basis for the study. The problem is formulated in terms of a system of two differential equations in two unknowns – the normal deflection of the plate and a modified Airy's stress function –, and the corresponding boundary and initial conditions. The numerical results show that the solution changes qualitatively when the load becomes larger than the critical load. A theory of plates which permits large strains is proposed. It reduces to the Von Karman – Foppl theory in the case of small strains. Dissert. Abstr.

N71-32710 New York Univ., N.Y.
THEORETICAL AND NUMERICAL STUDIES OF THE DEFLECTION OF THIN ELASTIC SHEETS
John William Vogel (Ph.D. Thesis) 1969 97 p
Avail: Univ. Microfilms Order No. 70-16112

The solution of a problem involving the finite deflection of a thin elastic membrane is presented. The problem is that of an initially plane membrane of arbitrary shape (but of uniform small thickness) under an arbitrary normal load and subject to uniform tension at its boundary. The equations are those of Foppl-Hencky for the stress function and deflection of such a membrane. The normal pressure is assumed to be small incomparison to the edge tension and the solution is expanded in a convergent power series in a parameter which is essentially a ratio of the normal load to the edge tension. The problem is restricted to a circular plane membrane under constant normal load and constant edge tension with the final stressed state as one of axial symmetry. A numerical comparison is made of the Foppl-Hencky theory and the theory of J. J. Stoker. Dissert. Abstr.

N71-32774# Lockheed Missiles and Space Co., Palo Alto, Calif.
FREE VIBRATIONS OF A CLOSED SPHERICAL SHELL SUBMERGED IN A FLUID
N. P. Fleishman et al [1970] 4 p refs Transl. into ENGLISH from Dopov. Akad. Nauk Ukr. RSR (USSR), Ser. A: Fiz.-Tekh. i Mate. Nauk, no. 2, 1970 p 1105–1108
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Free vibrations of a closed spherical shell submerged in a fluid which occupies the lower half space are investigated for different depths of shell submersion. The fluid was considered inviscid and incompressible. Equations describing the shell motion, fluid motion, and boundary conditions were given. The hydrodynamic pressure on the shell was determined on the basis of the linearized Lagrange-Cauchy integral. A generalized problem for the eigenvalues and eigenvectors of an infinite seven diagonal matrix was solved to determine the frequencies and modes of the free vibrations. J.G.M.

N71-32799*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STRAIN-RATE EQUATIONS FOR CALCULATION OF SECONDARY CREEP DEFORMATION OF THICK-WALLED TUBES WITH INTERNAL OR EXTERNAL PRESSURE
Richard E. Morris Washington Aug. 1971 16 p refs
(NASA-TM-X-2339; E-6226) Avail: NTIS CSCL 13M

Tubular structures such as heat exchangers and fuel-pin cladding may be operated at temperatures and stress levels such that creep occurs during normal operation for long lifetimes. Equations are presented relating the strain rate for secondary creep in thick-walled tubes at constant temperature with static internal pressure. Stress equations and strain-rate equations are given for the compressive secondary creep of thick-walled tubes at constant temperature with constant external pressure. The equations given are applicable in designing tubes undergoing secondary creep for long lifetimes with limited deformation. Author

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N71-31758# Ballistic Research Labs., Aberdeen Proving Ground, Md.
A CHEMICAL KINETICS COMPUTER CODE FOR MODELING IGNITION
James T. Dehn Jan. 1971 52 p refs
(AD-723400; BRL-MR-2092) Avail: NTIS CSCL 21/2

A computer program describing the detailed thermochemistry and diffusional propagation which occur during the ignition of a combustible gaseous mixture has been written and tested. It is capable of describing the evolution in time and space of the temperature, pressure and species concentrations of a reacting

system. In this report we restrict ourselves to homogeneous systems changing in time with or without temperature variation. In particular, the capabilities are illustrated of the code by comparing its predictions with various types of experimental data which are available for the hydrogen-oxygen system. It is also compared with an analytic model in order to highlight the principle chemical reactions involved. Author (GRA)

N71-31900# Battelle Memorial Inst., Columbus, Ohio.
THE FEDERAL R AND D PLAN FOR AIR POLLUTION CONTROL BY COMBUSTION-PROCESS MODIFICATION Final Report
11 Jan. 1971 352 p refs
(Contract CPA-22-69-147)
(PB-198066; APTD-0643) Avail: NTIS HC $6.00/MF $0.95 CSCL 13B

Results are reported of a study conducted for the Air Pollution Control Office to (1) identify gaps in combustion technology and (2) recommend a 5-year plan with priorities for effectively allocating resources for APCO supported combustion R and D directed toward meeting projected needs for air pollution control of energy conversion system by combustion modification. Combustion applications considered as elements of the plan include: central station power generation; industrial processing; industrial steam generation, commercial and residential heating; gas turbines and external combustion engines; and reciprocating internal combustion engines. A 5-year plan of combustion R and D is presented, with R and D opportunities identified and ranked in five priority levels. GRA

N71-32117# General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.
DEFICIENT COOLING Quarterly Progress Report, 1 Jul.–30 Sep. 1970
Oct. 1970 26 p
(Contract AT(04-3)-189)
(GEAP-10221-5; QPR-5) Avail: NTIS

A simplified transient analysis, for flow and/or pressure decay in a boiling system was coded for use with FORTRAN 4. The program was used to predict time of critical heat flow (CHF) in two actual runs. The results are very close, on the conservative side, to the actual data and other predictions obtained from a more complex code (SCAT) which calculates thermal conditions in a reactor core. Installation of the three-subchannel sampling system for the nine-rod test section was completed. Final inspection and hydro tests were completed to meet ASME code requirements. The TAPER code, for acquisition and reduction of transient data, has been expanded from seven- to fourteen-channel capability. Analysis of the transient flow as obtained by an orifice shows that flow data can be reduced by use of standard steady state orifice techniques. Author (NSA)

N71-32182# United Kingdom Atomic Energy Authority, Harwell (England). Atomic Energy Research Establishment.
HEAT TRANSFER TO GAS FLOWING IN CONVERGENT ANNULAR PASSAGES
T. D. A. Kennedy Dec. 1970 62 p refs
(AERE-R-6564) Avail: AEC Depository Libraries; HMSO 8s; BIS $1.70

Theoretical and experimental work on heat transfer to helium gas flowing in convergent annular passages is described. An effective method is sought for predicting heat transfer for design of in-pile experiments which aim at achieving constant surface temperature along the heated inner surface of the annulus by increasing the heat transfer coefficient progressively along the flow channel. A small computer program is described, which predicts conditions for ensuring laminar flow, and then predicts heat transfer coefficients for laminar flow conditions. The predicted heat transfer coefficients are compared with experimental results, and show good agreement at lower flows. Transition to turbulent flow seems to occur sooner than predicted, but this is considered to be caused by the 180 deg bend at the entrance to the annulus. Author (NSA)

N71-32191*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRELIMINARY SECTOR TESTS AT 920 K (1200 F) OF THREE AFTERBURNER CONCEPTS APPLICABLE FOR HIGHER INLET TEMPERATURES
Gregory M. Reck, J. Robert Branstetter, and Larry A. Diehl Washington Aug. 1971 42 p refs
(NASA-TN-D-6437; E-6057) Avail: NTIS CSCL 20M

Three afterburner flameholder concepts proposed for 1260 K inlet temperature were tested, and the results were compared with a conventional V-gutter flameholder. Tests of carbureting V-gutters, film vaporizing V-gutters, and swirl-can arrays were conducted in a 49-cm diameter duct with vitiated inlet air at 920 K, a velocity of 150 m/sec, and a pressure of 10.0 N/sq cm. Features of these designs included fuel-cooled flameholder surfaces for increased durability and premixed fuel-air systems to extend blowout limits. Carbureting V-gutters and film vaporizing V-gutters cooled the flameholder surfaces and extended the lean blowout limits relative to a conventional V-gutter. Swirl-can arrays also demonstrated an improvement in lean blowout performance. Combustion efficiency and total-pressure loss of all three flameholder concepts were comparable to a conventional V-gutter. Author

N71-32213*# Translation Consultants, Ltd., Arlington, Va.
TEMPERATURE RELAXATION OF A HIGHLY RARIFIED GAS [O TEMPERATURNOY RELAKSATSII SILNO RAZREZHENNOGO GAZA]
V. V. Andreyev, I. F. Mikhaylov, and L. V. Tanatarov Washington NASA Aug. 1971 20 p ref Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 16, no. 5, May 1971 p 721–733
(Contract NASw-2038)
(NASA-TT-F-13784) Avail: NTIS CSCL 20M

The problem of establishing the thermal relaxation of a rarefied gas in a closed volume, the surface temperature distribution being nonuniform, is discussed. The dependence of temperature on spatial coordinates and time is present. Reflection of particles from the boundary is taken as diffusive. The possibility of particle adsorption is considered, and the particle distribution function for a long time interval is obtained. Author

N71-32342# Sandia Corp., Albuquerque, N.Mex.
USER'S MANUAL FOR THE TWO DIMENSIONAL AXISYMMETRIC TRANSIENT HEAT CONDUCTION MATERIAL ABLATION COMPUTER PROGRAM ASTHMA
C. B. Moyer, B. F. Blackwell, and P. C. Kaestner Dec. 1970 215 p refs Sponsored by AEC
(SC-DR-70-510) Avail: NTIS

The input/output format for the ASTHMA computer program is detailed. The program is used for two-dimensional analysis of axisymmetric bodies such as reentry-vehicle heat shields, nose cones, or other transient heat-transfer problems where mass transfer may occur. Outputs include mass loss rates, surface recession rates, and temperature profiles. Author

N71-32401 Maryland Univ., College Park.
HEAT TRANSFER TO TWO PHASE FLUID-PARTICLE FLOW IN TUBES
Myron Gottlieb (Ph.D. Thesis) 1969 149 p
Avail: Univ. Microfilms Order No. 70-15488

An experimental model representing a first approximation to the geometry associated with capillary blood flow is proposed. The model consists of a precision bore glass tube through which water and large spherical particles passed. The effect of particle-to-tube diameter ratio, axial spacing between particles, and bulk flow rate on the rate of heat transfer from the tube wall, maintained at a uniform temperature, to the two phase fluid-particle system was established experimentally. A mathematical model is presented from which correlations are derived to predict the temperature rise and arithmetic mean Nusselt number of the system The correlations relate the temperature rise and Nusselt number of the system to the average liquid velocity, the particle velocity, the particle-to-tube diameter ratio, the geometry of the tube, the physical properties of the liquid and particle, the heat transfer coefficient associated with liquid flow in tubes when no particles are present, and an experimentally determined constant. The deviation of the data from the correlations is approximately 11 percent. Dissert. Abstr.

N71-32510# RAND Corp., Santa Monica, Calif.
STAGNATION POINT FREE CONVECTION FILM BOILING ON A HEMISPHERE
Joseph J. Sheppard, Jr. and Walter S. Bradfield (State Univ. of N.Y., Stony Brook) Feb. 1971 35 p refs
(P-4543) Avail: NTIS

Quasi-steady, approximate solutions are developed for stagnation-point free-convection film boiling on a hemisphere at atmospheric pressure, for the limiting cases of inertial dominance and viscous dominance. These solutions indicate that the phenomenon is dominated by viscous effects for a wide range of the film-boiling parameter beta = Re Pr and for engineering fluids with widely differing properties such as Freon-11 and water. The assumption of viscous dominance is a good approximation. The quasi-steady assumption is also valid over the range of beta and Re if in addition the Strouhal number St < or = to 0.3 and the Fourier number Fo < or = to 0.3. These latter conditions are not always satisfied for fluids of engineering interest over the ranges of beta and Re; e.g. they are satisfied for water but not always for Freon-11. When the conditions on St and Fo are not satisfied, the analysis indicates that the quasi-steady viscous solution applies to the equilibrium vapor layer thickness and heat flux for nonoscillating interfaces. Author

N71-32542 Maryland Univ., College Park.
CRITICAL HEAT FLUX IN LIQUID HELIUM 2 CLOSE TO THE LAMBDA TRANSITION
Bette Marcia Winer (Ph.D. Thesis) 1969 88 p
Avail: Univ. Microfilms Order No. 70-14951

Critical heat flux in liquid helium 2 near the lambda transition was experimentally investigated to evaluate the theory that the dominant consideration is fluctuations in the second sound modes of the system which become very large at the transition. A second theory derived by Mikesca from this hypothesis for the coupling of the superfluid to these critical fluctuations and the resultant breakdown of superfluidity was also examined. The experiment used the appearance of bubbles and the onset of a finite temperature gradient as indications that superfluidity had broken down. Specific measurements were made to determine when superfluidity breaks down due to the excitation of second sound modes as predicted by Mikesca's theory. Dissert. Abstr.

N71-32552# Lockheed Missiles and Space Co., Palo Alto, Calif.
GAS REFRIGERATOR WITH THERMAL DRIVER
A. D. Suslov et al 1971 5 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Mashinostr. (Moscow), no. 3, 1971 p 99-103
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

A description of a gas refrigerator based on a thermal driver principle is presented. An analysis of the influence of geometrical relationships of the working volumes on the real machine efficiency is provided. The main advantage of a gas refrigerator with a thermal driver is the direct conversion of energy. Its optimum use occurs in situations where electrical power is limited. Author

N71-32555# RAND Corp., Santa Monica, Calif.
SENSITIVITY ANALYSIS IN CHEMICAL THERMODYNAMICS
J. H. Bigelow and N. Z. Shapiro Apr. 1971 18 p refs
(P-4628) Avail: NTIS

The problem of finding the equilibrium (or steady-state) composition of a chemical system may be formulated as a constrained extremum problem. Computation of not only the composition, but also its dependence on the parameters of the system. This sensitivity analysis is done as follows: (1) convert the problem essentially to a geometric program, to circumvent difficulties which arise from the boundary behavior of the original objective function; (2) write the Kuhn-Tucker optimality conditions; and (3) apply the implicit function theorem. The resulting derivatives of composition variables with respect to parameters incidentally offer a method for solving the original problem. Author

34 GENERAL

Includes information of a broad nature related in industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents.

N71-31615# Federal Aviation Administration, Washington, D.C. Systems Research and Development Service.
SCIENTIFIC AND TECHNICAL REPORTS, 1970
1970 33 p
Avail: NTIS

A listing of all technical reports prepared by or for the Systems Research and Development Service that were made available to the public during 1970 is provided. These reports were prepared in connection with various scientific or technical projects, tasks, or contracts which support the service's mission to analyze, formulate, and design the improvement and modernization of the National Airspace System and bear information of interest to the general aviation industry and community. Author

N71-31624# Department of Transportation, Washington, D.C.
INVESTIGATION OF CHARTER AIRCRAFT SERVICES, VOLUME 1
5 Feb. 1971 82 p refs
(PB-197638) Avail: NTIS CSCL 01B

An in-depth investigation of charter operations utilizing large airplanes was conducted to determine the true condition of air charter operations. The investigation included activities peripheral to the commercial operation of large airplanes and any and all other factors affecting the safety of this segment of the aviation industry. It is agreed that the regulated air carriers and commercial operators are not fulfilling the total demands of the marketplace. However, the limited time allocated to the project precluded the full development of information relating to the magnitude of the requirement for air charter operations. E.M.C.

N71-31648# Infotran, Inc., New York.
A CHECKLESS SOCIETY OR AN UNCHECKED SOCIETY?
Rudy C. Stiefel *In* Kentucky Univ. Proc. of 1970 Carnahan Conf. on Electron. Crime Countermeas. Apr. 1970 p 166-171 (See

N71-31628 19-07)
Avail: NTIS

A discussion is presented of the 'cash and checkless' society of the future in which it will be possible to execute, electronically, financial transactions from pennies to billions within fractions of a second over any distance. Emphasis is placed on the inherent opportunities for fraud within a system of this nature. It is concluded that until such time as appropriate anti-fraud measures can be effected, the common check may remain as the backbone for the safe transfer of property. D.L.G.

N71-31777# Pittsburgh Univ., Pa. Dept. of Chemistry.
A CHEMICAL INFORMATION CENTER EXPERIMENTAL STATION Final Report
Edward M. Arnett 31 Mar. 1971 231 p refs
(Grant NSF GN-738)
(PB-198791) Avail: NTIS CSCL 05B

Details are given on the computer-based information center, its system design, implementation, retrieval system, the research user's approach, and the internal and external interactions. N.E.N.

N71-31976# Joint Publications Research Service, Washington, D.C.
INFORMATION RETRIEVAL IN THE FIELD OF CHEMISTRY
I. L. Knunyants, ed. 6 Jul. 1971 171 p refs Transl. into ENGLISH from Zh. Vses. Khim. Obshchestva im. D. I. Mendeleeva (Leningrad), v. 16, no. 1, 1971 p 2-79
(JPRS-53523) Avail: NTIS

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3. SCIENTIFIC-TECHNICAL LITERATURE ON CHEMISTRY AND CHEMICAL TECHNOLOGY R. S. Gilyarevskiy p 39-58 refs (See N71-31979 19-34)

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6. MAJOR SOVIET INFORMATION INSTITUTES ON CHEMISTRY AND CHEMICAL TECHNOLOGY L. M. Shulov p 100-116 refs (See N71-31982 19-34)

7. INFORMATION RETRIEVAL IN THE FIELD OF REACTIONS OF ORGANIC CHEMISTRY G. L. Mishchenko p 117-136 refs (See N71-31983 19-34)

8. RETRIEVAL OF CHEMICAL COMPOUNDS IN DATA RETRIEVAL SYSTEMS L. A. Shevyakova p 137-146 refs (See N71-31984 19-34)

9. RETRIEVAL OF DATA ON CHEMICAL COMPOUNDS AND MATERIALS WITH THE AID OF MANUAL DATA RETRIEVAL SYSTEMS V. S. Shteyn p 147-156 refs (See N71-31985 19-34)

10. IPS-ftor: MEANS FOR CURRENT ANNOUNCEMENT AND RETROSPECTIVE RETRIEVAL OF INFORMATION IN THE CHEMISTRY OF FLUORORGANIC COMPOUNDS G. L. Mishchenko p 157-168 refs (See N71-31986 19-34)

N71-31977# Joint Publications Research Service, Washington, D.C.
TECHNICAL PROGRESS AND SCIENTIFIC-TECHNICAL INFORMATION
A. I. Mikhaylov *In its* Inform. Retrieval in the Field of Chem. 6 Jul. 1971 p 1-9 refs (See N71-31976 19-34)
Avail: NTIS

The development, differentiation, specialization, and interaction of scientific fields in chemistry are discussed including the resultant increase in recorded scientific and technical information and its dissemination and utilization. The network of information agencies in the U.S.S.R. is summarized along with the principal functions performed by the datamation centers. J.M.

N71-31978# Joint Publications Research Service, Washington, D.C.
MODERN INTEGRAL INFORMATION SYSTEMS FOR CHEMISTRY AND CHEMICAL TECHNOLOGY
A. I. Chernyy *In its* Inform. Retrieval in the Field of Chem. 6 Jul. 1971 p 10-38 refs (See N71-31976 19-34)
Avail: NTIS

A brief analysis is presented of periodicals in which chemical scientific and technical literature is published. The basic requirements of information systems for chemistry are outlined as well as the information functions of abstract journals. The technological disadvantages in journal publication are summarized. The use of computers and automation in weekly journal preparation is cited to reduce the time lag in information dissemination. The analytical processing of documents for an integral information system is described including data card entries, the digital computer, new data input, data retrieval, and operation in normal packet mode. The types of publications and in information services are reviewed for a chemical abstracts service as well as a general outline of the integral information system used. The comparative effectiveness of various information publications and services for chemistry and chemical technology is presented. J.M.

N71-31979# Joint Publications Research Service, Washington, D.C.
SCIENTIFIC-TECHNICAL LITERATURE ON CHEMISTRY AND CHEMICAL TECHNOLOGY
R. S. Gilyarevskiy *In its* Inform. Retrieval in the Field of Chem. 6 Jul. 1971 p 39-58 refs (See N71-31976 19-34)
Avail: NTIS

Datamation, which investigates the structure and general properties of scientific information and the principles of scientific communication processes, and journal publishing are discussed. The distribution of publications in various branches of science and the aging of scientific literature are included. The classification of scientific publication and document forms is outlined. A bibliographic listing of books and periodic publications pertinent to chemistry and chemical technology is given with content summaries. J.M.

N71-31980# Joint Publications Research Service, Washington, D.C.
THE CHEMIST AND THE INFORMATION SYSTEM
G. E. Vleduts et al *In its* Inform. Retrieval in the Field of Chem. 6 Jul. 1971 p 59-78 refs (See N71-31976 19-34)
Avail: NTIS

The importance of the human-machine effort in information retrieval of chemical data in USSR is assessed. The data stored is in turn used by the chemist as background for furthering his research, as well as for the selective dissemination of results in various branches of chemistry. Examples of structural formulas processed and printed by the UNIVAC ICT 1004 are included. E.M.C.

N71-31981# Joint Publications Research Service, Washington, D.C.
BASIC SECONDARY PUBLICATIONS ON CHEMISTRY AND CHEMICAL TECHNOLOGY
E. K. Kuznetsova *In its* Inform. Retrieval in the Field of Chem.

6 Jul. 1971 p 79–99 refs (See N71-31976 19-34)
Avail: NTIS

A cursory review of the basic types of secondary publications on chemistry and chemistry technology reveals progress in documental flow. Permuted indexes and annotated bibliographic data lend support to basic textual data obtained in abstracts, primary journals, reviews, and other special references. E.M.C.

N71-31982# Joint Publications Research Service, Washington, D.C.

MAJOR SOVIET INFORMATION INSTITUTES ON CHEMISTRY AND CHEMICAL TECHNOLOGY

L. M. Shulov *In its* Inform. Retrieval in the Field of Chem. 6 Jul. 1971 p 100–116 refs (See N71-31976 19-34)
Avail: NTIS

The importance of a unified information system for the major Soviet institutes on chemistry and chemical technology is stressed. Services for different branches are outlined and their interrelationship in the country and contribution to foreign countries are detailed. Information is provided in catalogs, bibliographies, reviews, and abstracts; also data on inventions, foreign patents, and industrial models are reported periodically. E.M.C.

N71-31983# Joint Publications Research Service, Washington, D.C.

INFORMATION RETRIEVAL IN THE FIELD OF REACTIONS OF ORGANIC CHEMISTRY

G. L. Mishchenko *In its* Inform. Retrieval in the Field of Chem. 6 Jul. 1971 p 117–136 refs (See N71-31976 19-34)
Avail: NTIS

The possibilities of retrieving information on organic chemical reactions using monographs, reference literature, and subject indices as sources are investigated. The disadvantages and advantages of the sources are discussed. The K sub 1, 2, and 3 type reactions and manual and automatic indexing of the reactions are given. E.H.W.

N71-31984# Joint Publications Research Service, Washington, D.C.

RETRIEVAL OF CHEMICAL COMPOUNDS IN DATA RETRIEVAL SYSTEMS

L. A. Shevyakova *In its* Inform. Retrieval in the Field of Chem. 6 Jul. 1971 p 137–146 refs (See N71-31976 19-34)
Avail: NTIS

Methods to retrieve information concerning chemical compounds, their reactions, and properties are discussed. Both manual and mechanized methods and the economic effectiveness of the methods are discussed. E.H.W.

N71-31985# Joint Publications Research Service, Washington, D.C.

RETRIEVAL OF DATA ON CHEMICAL COMPOUNDS AND MATERIALS WITH THE AID OF MANUAL DATA RETRIEVAL SYSTEMS

V. S. Shteyn *In its* Inform. Retrieval in the Field of Chem. 6 Jul. 1971 p 147–156 refs (See N71-31976 19-34)
Avail: NTIS

The problems involved in obtaining information on the properties of chemical compounds and materials are discussed. The manual factographic system and automatic data retrieval system on punch cards are also discussed. The advantages and disadvantages of both systems are given. E.H.W.

N71-31986# Joint Publications Research Service, Washington, D.C.

IPS-ftor: MEANS FOR CURRENT ANNOUNCEMENT AND RETROSPECTIVE RETRIEVAL OF INFORMATION IN THE CHEMISTRY OF FLUORORGANIC COMPOUNDS

G. L. Mishchenko *In its* Inform. Retrieval in the Field of Chem. 6 Jul. 1971 p 157–168 refs (See N71-31976 19-34)
Avail: NTIS

A special data system IPS-ftor is described. The system is capable of solving the problems of operative current announcement and retrospective retrieval, at the same time using new capabilities along with the traditional ones. The system is designed primarily for information retrieval in the chemistry of fluororganic compounds. E.H.W.

N71-32006# Joint Publications Research Service, Washington, D.C.

SUPPLEMENT: USSR PROPOSES TREATY ON PEACEFUL USE OF THE MOON

A. A. Gromyko *In its* Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 256 15 Jul. 1971 p 54–61 (See N71-32000 19-30)
Avail: NTIS

An international treaty, proposed by the Soviet Union, for the peaceful use and exploration of the moon is presented. E.H.W.

N71-32019# Joint Publications Research Service, Washington, D.C.

NATURE OF SOCIAL FORECASTING DESCRIBED

M. N. Rutkevich et al *In its* Math. and the Sci. Method 23 Jul. 1971 p 26–38 refs (See N71-32016 19-19)
Avail: NTIS

The importance of sociology in specific tasks of social planning is developed and applied to forecasting methods for industrial enterprises. Sociological planning and forecasting covers social consequences of scientific-technical progress; changes in social structure and development of culture, science, education, art, family relations, and other aspects. It is shown that the various processes in social life require differentiated approaches with consideration of their internal specifics in order to find exact numerical indicators. G.G.

N71-32020# Joint Publications Research Service, Washington, D.C.

SOCIAL ASPECTS OF PREVISION DISCUSSED

O. B. Nikolayev *In its* Math. and the Sci. Method 23 Jul. 1971 p 39–50 refs (See N71-32016 19-19)
Avail: NTIS

The problems of scientific prevision and planned reorganization of social life deal with the analyses of gnosiological and logical aspects and the development of practical forecasting methods. A prevision is defined as an effort aimed at imagining a picture of the future, or acquiring information about it, that results in a model of reality expressed in images, concepts, or mathematical symbols. G.G.

N71-32029# Army Tropic Test Center, Fort Clayton (Canal Zone).

ENVIRONMENTAL DATA BASE FOR REGIONAL STUDIES IN THE HUMID TROPICS Final Report

Thomas C. Crebbs, Michael A. Fradel, Edward E. Garrett, George W. Gauger, Wilfried H. Portig et al Aug. 1970 99 p refs (ARPA Order 740)
(AD-723060; USATTC-7008004) Avail: NTIS CSCL 8/6

The report presents a summation of the Environmental Data Base Project which was undertaken by the US Army Tropic Test Center (USATTC) in 1964. The objective of this project was the gathering and storage of detailed, specific data on militarily significant factors of a humid tropic environment. Progress reports have been issued on a semiannual basis; they have covered the project activities and methods of data collection and presented selected technical findings and analyses of portions of the data. Author (GRA)

N71-32186# Naval Ship Research and Development Center, Washington, D.C.
AN EVALUATION OF ON-LINE INFORMATION RETRIEVAL SYSTEM TECHNIQUES Final Report
Theodore Wolfe Dec. 1970 65 p refs
(AD-723214; NSRDC-3458) Avail: NTIS CSCL 5/2

The report reflects current developments in on-line information retrieval systems and suggests goals for future developments of these systems. The review and comparison of the three major on-line information retrieval systems discussed in the paper reflect current achievements in working on-line information retrieval systems. A final section is devoted to suggestions for exploiting the potential of on-line remote access information retrieval and display systems. Author (GRA)

N71-32196# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
QUARTERLY PROGRESS REPORT NO. 101
H. J. Zimmermann, G. G. Harvey, and S. J. Mason 15 Apr. 1971 305 p refs
(Contracts DA-28-043-AMC-02536(E); N00014-67-A-0204-0033) (AD-723340; QPR-101) Avail: NTIS CSCL 9/4

Contents: General physics; Plasma dynamics; Communication sciences and engineering. GRA

N71-32198# Oklahoma Univ. Research Inst., Norman.
ESCAPE WORTHINESS OF VEHICLES AND OCCUPANT SURVIVAL. PART 2: APPENDICES. PART 3: RESEARCH AND DEVELOPMENT PLAN Final Report
Dec. 1970 348 p refs
(Contract DOT-FH-11-7303)
(PB-198773; OURI-1729-FR-1-2; DOT-HS-800-429) Avail: NTIS HC $6.00/MF $0.95 CSCL 13L

Multidisciplinary study of crash survivability contains the appendices, a bibliography, surveys of previous submergence tests, a detailed engineering analysis of submergence hydrodynamics, a summary of conventional flammability tests and test standards, and a compilation of the ignition data and spectral absorptance measurements on vehicle interior materials. A multiyear interdisciplinary research and development plan designed to provide the information on crash survivability, to quantify the appropriate escape worthiness characteristics, to define substantive flammability test methods and performance criteria for flammability of vehicle interior materials, and to devise other control techniques and vehicle design features for fire prevention and control is also described. Author (GRA)

N71-32247# Oklahoma Univ. Research Inst., Norman.
ESCAPE WORTHINESS OF VEHICLES AND OCCUPANT SURVIVAL. PART 1: RESEARCH PROGRAM Final Report
C. M. Sliepcevich, W. D. Steen, J. L. Purswell, J. N. Ice, and J. R. Welker Dec. 1970 428 p refs
(Contract DOT-FH-11-7303)
(PB-198772; OURI-1729-FR-1-1; DOT-HS-800-428) Avail: NTIS HC $6.00/MF $0.95 CSCL 13L

Results are reported of the factors involved in escape of occupants from crashed vehicle environments in which the vehicle is incapacitated on land, submerged in water or involved in fire. This volume summarizes the investigative efforts, results and conclusions. Analysis of the availability and accessibility of information, including the published literature, reports, accident records and other documents related to escape worthiness of vehicles and occupant survival revealed that the quality and reliability of these resources were inadequate to provide guidance for clarifying or resolving these problem areas. Vehicle characteristics and human behavior are reflected in escape times for various passenger-population loads. Additional testing involved bus side window retention and glazing strength. Extensive flammability tests were conducted on over fifty materials used in the interior of vehicles. GRA

N71-32285# RAND Corp., Santa Monica, Calif.
HOW SHALL WE EMPLOY THE TECHNICALLY TRAINED?
Victor Gilinsky Feb. 1971 10 p refs
Avail: NTIS

Manpower employment problems are summarized which have developed from the concentration of government research and development expenditure in a small number of industries in order to meet narrow high-priority technological goals, and the channeling of government funds to universities in order to provide the industries with large numbers of specialists. The rapid change, incentives of industry and universities, education and retraining, and the institutional commitment are discussed. J.M.

N71-32294# RAND Corp., Santa Monica, Calif.
TECHNOLOGY TRANSFER MODEL
Samuel N. Bar-Zakay Nov. 1970 30 p refs
(P-4509) Avail: NTIS

A model is developed for the transfer of technology from an advanced country to an underdeveloped country. Details are given on the search, adaptation, implementation, and maintenance stages, and technological forecasting, long-range planning, and project-related intelligence activities are described. It is concluded that the recipient (and the donor) must have considerable analytic capabilities, and the sooner the forecasting, planning, and intelligence activities are created, the sooner the developing countries will be able to utilize their scarce resources more efficiently. It is also concluded that the developing countries must perform the technological assessment and analyze the socioeconomic implications of the technological development. N.E.N.

N71-32299 National Lending Library for Science and Technology, Boston Spa (England).
OPTIMISATION OF TEST INTERVALS FOR DEFECTIVE STANDBY SYSTEMS
P. Daublebsky 25 Aug. 1970 11 p refs Transl. into ENGLISH from Brennstoff-Waerme-Kraft (West Germany), v. 22, no. 6, 1970 p 283-287
(NLL-RISLEY-Trans-2004-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.

Functional groups on standby must be regularly checked and maintained in order to safeguard their reliability. A new method is described for determining reduced test intervals for defective functional groups, which is suitable for any special cases. The basis of the calculation is the required maximum permissible failure probability of a functional group. If one or more components are found to be failed in a test, it is possible in many cases to continue to operate the plant if the remaining functional groups with the same function are checked more frequently. Functional groups are examined whose components are available during the test to come into action on sudden call-up, and ones which are not available. The theory is illustrated on the example of a boiling water reactor. Author

N71-32352# National Bureau of Standards, Washington, D.C.
TESTIMONY OF NATIONALLY REPRESENTATIVE GROUPS: US METRIC STUDY Interim Report
Jeffrey P. Odom, ed. Jul. 1971 174 p
(NBS-SP-345-12) Avail: SOD $1.50

Testimony of nationally representative groups regarding conversion to the metric system in the United States is presented. These presentations supplement information collected by individual surveys and investigations conducted by the National Bureau of

Standard's U.S. Metric Study authorized by Congress under the Metric Study Act of 1968. A total of 234 groups gave opinions and cost-benfit estimates, representing 674,000 firms and 19,600,000 individuals. Trade associations, labor unions, professional societies, and other national organizations were included. A.C.R.

N71-32363# National Bureau of Standards, Washington, D.C.
THE CONSUMER: US METRIC STUDY Interim Report
Bruce D. Rothrock, ed. Jul. 1971 145 p refs
(NBS-SP-345-7) Avail: SOD $1.45

Results are presented from an investigation of the probable impact of U.S. conversion to the metric system of measurement on the average consumer and his attitudes toward this change. The work was authorized by the Metric Study Act of 1968 and conducted by the National Bureau of Standards. Included were a survey of attitudes and opinions of consumers and their level of knowledge of both the customary and metric systems, as well as expert testimony on the present impact of metrication on selected consumer activities. Possible future effects under a planned program of metrication and for the case in which no systematic attempt is made to increase metric use were also considered. The survey indicated that a majority of consumers are satisfied with the customary system, and that they have very little knowledge of the metric system. They can be expected to react with apathy and indifference to any planned conversion system. A.C.R.

N71-32375*# Washington Univ., Seattle.
APPLICATION OF COMMUNICATIONS SATELLITES TO EDUCATIONAL DEVELOPMENT: AN OVERVIEW OF THE WASHINGTON UNIVERSITY PROGRAM
Robert P. Morgan, Jai P. Singh, Herbert M. Ohlman, and James R. DuMolin May 1971 32 p refs Presented at the Colloq. Intern., Les Satellites d'Educ., Centre Natl. d'Etudes Spatiales, Nice, 3–7 May, 1971
(Grant NGL-26-008-054)
(NASA-CR-119680) Avail: NTIS CSCL 05I

An interdisciplinary research and education program to examine the potential and problems associated with the use of communications satellites to help meed educational needs in the United States is discussed. A major objective is to synthesize and to make available to decision makers a small number of alternative educational satellite systems in which technical, educational, social, legal, economic, and political factors have been carefully analyzed. The progress in four areas including needs analysis, communications technology studies, systems synthesis, and the educational impact of the program on Washington University is reported. Author

N71-32421# National Bureau of Standards, Washington, D.C.
US METRIC STUDY: EDUCATION Interim Report
Jul. 1971 209 p refs
(NBS-SP-345-6) Avail: SOD $1.75

The effects of increasing worldwide use of the metric system on education in the United States are discussed. The educational advantages and disadvantages of both the metric and the customary systems of units are assessed. The current usage of metric measures in US schools and trends in that usage are determined. Ways in which education would have to change as the US accomodates to increased worldwide use of the metric system, under a laissez faire or a planned approach, are identified, and the costs of the changes are estimated. Recommendations of ways in which to take the best advantage of the changes are made. Ways of achieving curriculum changes needed in view of increasing metric usage are also discussed. Texts of key papers presented at the Education Conference held in October 1970 are also included. Author

N71-32458*# Naval Research Lab., Washington, D.C.
REPORT OF NRL PROGRESS
Jun. 1971 44 p refs
Avail: NTIS CSCL 14B

The dilution refrigerator is a laboratory research facility for producing and maintaining temperatures near absolute zero. Refrigeration is produced by utilizing some of the unique low-temperature properties of liquid Helium(3) and dilute solutions of Helium(3) dissolved in liquid Helium(4). The dilution refrigerator can reach 0.01K continuously, and, with a circulation rate of 1.2 × 10 to the minus 5th power moles/sec of Helium(3), it provides 100 ergs/sec of cooling power at 0.1K. Author

N71-32495*# Maryland Univ., College Park. Computer Science Center.
A CRITICAL LOOK AT PERT ANALYSIS
Richard M. Nicholson Apr. 1971 110 p refs
(Grant NGL-21-002-008)
(NASA-CR-119777; TR-154) Avail: NTIS CSCL 05A

The assumptions inherent in most PERT implementations, particularly that of the critical path, are investigated and the errors which can result from PERT analysis are indicated. A model for performing the PERT calculations without these errors resulting is derived and output from this model is displayed. A system for project management incorporating this model is described. A program listing of the model implemented is presented. Author

N71-32521# Indiana Univ. Foundation, Bloomington. Aerospace Research Applications Center.
OPERATION OF A UNIVERSITY-BASED TECHNOLOGY AND INFORMATION TRANSFER CENTER
Joseph Di Salvo [1970] 137 p refs
(Contract NASw-1942)
(NASA-CR-121283) Avail: NTIS CSCL 05B

The problem of effectively utilizing technical information, which is so prolifically being generated by our society is characterized as one of the great challenges facing mankind. The topic is covered in some detail from an operational experience viewpoint. The experimental efforts undertaken to transfer technology via a university-based information Center to industrial organizations are reviewed. Information requirements and habits of industrial scientists and engineers are discussed. Information services and products designed to meet the requirements are presented. A system of cost accounting for an information dissemination function is described as well as experiences in market acceptance of the concept of buying information services. Selected transfer case histories are discussed and a number of implications of the technology transfer process are reviewed. Some suggestions for application of further resources are made. Author

N71-32524 Bureau of National Affairs, Inc., Washington, D.C.
STATE AIR POLLUTION CONTROL LAWS
Stanley E. Degler 1970 97 p Revised
Copyright. Avail: Issuing Activity

The air pollution control laws in effect in all states are summarized, and the complete texts of the California Mulford-Carrel Air Resources Act and the Model State Air Pollution Control Act are given. J.G.M.

N71-32525# Florida Univ., Gainesville.
QUANTUM THEORY PROJECT FOR RESEARCH IN ATOMIC, MOLECULAR AND SOLID-STATE CHEMISTRY AND PHYSICS Annual Progress Report, 1970–1971
1 Apr. 1971 65 p Report from the Quantum Chem., Solid-State Physics and Quantum Biology and the Intern. Symp. on Atomic, Molecular, Solid-State Theory and Quantum Biology, 7 Dec. 1970–23 Jan. 1971 Sponsored in parts by Univ. of Uppsala and IBM

(Rept-224) Avail: NTIS

The staff, lecture topics, and a brief description of each course for the 1970–1971 Winter Institute are given. A basic orientation course in the field of modern quantum theory was followed by advanced courses in atomic, molecular, solid-state quantum mechanics, and quantum biology. F.O.S.

N71-32531# RAND Corp., Santa Monica, Calif.
WHERE WILL ALL THE PEOPLE GO? HOW MUCH WILL THEY DUMP WHEN THEY GET THERE?: POPULATION DISTRIBUTION, ENVIRONMENTAL DAMAGE, AND THE QUALITY OF LIFE
Anthony H. Pascal Mar. 1971 6 p Presented at the Ann. Meeting of the Western Regional Sci. Assoc., Santa Barbara, Calif., 25–28 Feb. 1971
(P-4599) Avail: NTIS

The various aspects of increasing population on the standard of living of a nation are discussed. Research projects to obtain better understanding of the problem are proposed. Specific subjects of concern are: (1) forecasting the spatial settlement pattern for U.S. in year 2000, (2) estimating the threat to the environment, (3) specifying environmental standards, (4) identifying and assessing policy mechanisms, and (5) calculating the magnitude and incidence of costs. Author

N71-32573# RAND Corp., Santa Monica, Calif.
BIBLIOGRAPHY ON AUTOMATION AND TECHNOLOGICAL CHANGE AND STUDIES OF THE FUTURE
Annette Harrison Mar. 1971 58 p refs
(P-3365-4) Avail: NTIS

A bibliography on automation and technological change, along with proposed future investigations, is presented, containing 1200 entries. This list includes entries varying from computer technology for communication systems to its effects on the human population both socially and culturally. J.A.M.

N71-32589# Research Triangle Inst., Durham, N.C. Operations Research and Economics Div.
USER'S MANUAL AUTOMATED PROCEDURES FOR ESTIMATING CONTROL COSTS AND EMISSION REDUCTIONS FOR SPECIFIED AIR POLLUTION SOURCES, VOLUME 2 Final Report
H. S. Anderson, R. E. Paddock, R. O. Lyday, M. E. Fogel, and E. L. Hill Dec. 1970 297 p
(Contract CPA-70-60)
(PB-198779; RTI-FR-OV-534-Vol-2; APTD-0665-Vol-2) Avail: NTIS CSCL 13B

A user's manual is presented which facilitates the use and modification of the computer programs developed within this research project for estimating the costs and emissions of specified industrial air pollution sources. The output from each source program consists of emission estimates, both before and after control, as well as required control costs on a plant by plant basis. The manual describes the input requirements, operational characteristics, and output characteristics for each program. Author (GRA)

N71-32620# National Research Council of Canada, Ottowa (Ontario).
DIVISION OF MECHANICAL ENGINEERING AND THE NATIONAL AERONAUTICAL ESTABLISHMENT Quarterly Bulletin, 1 Jan.–31 Mar. 1971
Mar. 1971 101 p refs
(DME/NAE-1971(1)) Avail: NTIS

CONTENTS:

1. FREE PISTON ENGINE HISTORICAL BACKGROUND AND RECENT STUDIES J. J. Samolewicz p 1–18 refs (See N71-32621 19-28)

2. HUMAN FACTORS ENGINEERING L. Buck p 19–26 refs (See N71-32622 19-05)

3. SOME PRELIMINARY ASSESSMENTS OF COMPRESSIBLE TURBULENT BOUNDARY LAYER STUDIES AT MACH 4 AND AT HIGH REYNOLDS NUMBERS, INCLUDING FLOWS IN RELAXING AND ADVERSE PRESSURE GRADIENTS D. J. Peake, J. M. Romeskie (McGill Univ., Montreal), and G. Brakmann (McGill Univ., Montreal) p 27–99 refs (See N71-32623 19-12)

N71-32624# Coast Guard, Washington, D.C.
OIL POLLUTION LIABILITY AND FINANCIAL RESPONSIBILITY. A REPORT TO THE PRESIDENT AND THE CONGRESS Final Report
Dec. 1970 25 p
(PB-198775; USCG-OIL-70-1) Avail: NTIS

The report summarized a study on the need for measures to provide financial responsibility and limitation of liability for vessels, onshore and offshore facilities for costs of removing discharged oil and payment of damages resulting from the discharge. The report recommends to the President and the Congress no change in liability for vessels, federal preemption for vessels in interstate commerce, and that varying schedules of proof of financial responsibility of onshore and offshore facilities be established based on the pollution potential of the facility. GRA

N71-32625# George Washington Univ., Washington, D.C.
LEGAL, ECONOMIC, AND TECHNICAL ASPECTS OF LIABILITY AND FINANCIAL RESPONSIBILITY AS RELATED TO OIL POLLUTION Final Report
Dec. 1970 347 p refs
(Contract DOT-CG-10255-A)
(PB-198775; USCG-OIL-70-2) Avail: NTIS HC $6.00/MF $0.95 CSCL 13B

An intensive study of the oil pollution problem in its legal, economic and technical aspects is presented. The contents include the following: Analysis of the water quality improvement act; Theories of liability and their relation to oil pollution; Potential problems of the act; Jurisdiction; Economic principles of liability and financial responsibility for oil pollution; Oil pollution prevention and carrier liability; Economic models for analysis of problems; Relationships between cleanup costs and quantity of oil spilled; Measures of the potential economic loss from pollution; International trade implications of U.S. policies; The nature, behavior, and ecological effects of oil spills; Method for containment and cleanup of oil spills; and Oil pollution prevention and the characteristics of the oil industry production, transporting, and storage facilities. GRA

N71-32639# National Science Foundation, Washington, D.C.
RESEARCH AND DEVELOPMENT IN LOCAL GOVERNMENTS, FISCAL YEARS 1968 AND 1969
Wayne Zajac et al Jan. 1971 64 p refs
(NSF-71-6) Avail: SOD $0.65

Information and data on the nature and extent of local government participation in research and development is presented for the fiscal years 1968 and 1969. Data cover problems of modern society-poverty, crime, inadequate education, and pollution. Also discussed are new techniques, methods, and equipment to alleviate some of these conditions. The data are compared to that of fiscal years 1966 and 1967. E.H.W.

N71-32653 Bureau of National Affairs, Inc., Washington, D.C.
FEDERAL POLLUTION CONTROL PROGRAMS: WATER, AIR, AND SOLID WASTES

Stanley E. Degler 1971 181 p Revised
Avail: NTIS

The federal programs for environmental pollution control are discussed in detail with emphasis on federal spending, research, standards-setting, and enforcement for air, water, and solid wastes. Author

N71-32657# Committee on Appropriations (U.S. House).
DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT AND OTHER AGENCIES, APPROPRIATIONS, 1972 From Committee of Conference
Edward P. Boland Washington GPO Jul. 1971 9 p Rept. to accompany H.R. 9382 presented by Comm. on Appropriations at the 92d Congr., 1st Sess., 26 Jul. 1971
(Rept-92-377) Avail: US Capitol, House Document Room

Amendment agreement recommendations and brief explanations of the amendments on making appropriations for the Department of Housing and Urban Development for space, science, veterans, and certain other independent executive agencies, boards, commissions, corporations, and offices for the fiscal year ending 30 June 1972 are presented. J.M.

N71-32689# Committee on Foreign Affairs (U.S. House).
AIRCRAFT HIJACKING
Washington GPO 1970 203 p refs Hearings on resolutions concerning aircraft hijacking and related matters before Comm. on Foreign Affairs, 91st Congr., 2d Sess., 17, 22, 23, and 30 Sep. 1970
Avail: Comm. on Foreign Affairs

Problems involved with aircraft hijacking are discussed including property losses to aircarriers, personal safety, and effects on governments and international relations. Various resolutions concerning hijacking which were introduced to the Congress are included. Hijacking statistics on worldwide and U.S.-registered aircraft are appended. J.M.

N71-32692# National Science Foundation, Washington, D.C.
SCIENTIFIC ACTIVITIES OF INDEPENDENT NONPROFIT INSTITUTIONS: REPORT ON A SURVEY OF 1970 EMPLOYMENT AND 1969 EXPENDITURES
1970 71 p
(NSF-71-9) Avail: SOD $0.70

The results of the National Science Foundation's 1970 survey of scientific activities of independent nonprofit institutions are summarized. It excludes scientific activities funded by nonprofit institutions, but performed by other organizations and includes voluntary nonprofit hospitals. Total employment including scientists, engineers, and technicians; total expenditures; and intramural R and D performance of nonprofit institutions are reviewed. Author

N71-32700# Smithsonian Institution, Washington, D.C. Office of Academic Programs.
OPPORTUNITIES FOR RESEARCH AND ADVANCED STUDY, 1971-1972
1970 251 p
Avail: NTIS

Smithsonian study and research facilities are described under nine categorical headings reflecting academic disciplines. Listings for individual museums may be divided among different categories. Some units may appear under several categories and to some extent the academic disciplines overlap. Professional staff members, along with their biographical data, are listed in accordance with their research interests and activities under the appropriate educational program. Thus some staff members' listings will appear more than once. Staff listings are intended to provide assistance to applicants in determining areas of research which can be undertaken at the Institution. Author

N71-32708# RAND Corp., Santa Monica, Calif.
TECHNOLOGICAL RISK VERSUS NATURAL CATASTROPHE
L. M. Libby Mar. 1971 6 p refs
(P-4602) Avail: NTIS

The risk of death from unavoidable natural catastrophes is compared with risk of death incurred by the electrical industry (including risk from nuclear power). The unavoidable natural catastrophes considered are death from meteor falls, from climatic deterioration caused by changes in amount of sunlight reaching the earth, and from supernovae. Such comparisons may help government agencies balance public risks against public benefits in planning for new technologies. Author

N71-32720# National Bureau of Standards, Washington, D.C.
COMMERCIAL WEIGHTS AND MEASURES: US METRIC STUDY Interim Report
Jul. 1971 107 p
(NBS-SP-345-3) Avail: SOD $1.00

The impacts (cost, time, etc.) which metrication would have on commercial weights and measures activities are explored. The cost of adapting or changing commercial weighing and measuring devices to record and/or indicate in metric units is analyzed and the effects of metrication on state and local weights and measures jurisdictions are reviewed. Author

N71-32721# National Bureau of Standards, Washington, D.C.
DEPARTMENT OF DEFENSE: US METRIC STUDY Interim Report
L. E. Barbrow Jun. 1971 125 p
(NBS-SP-345-9) Avail: SOD $1.25

The results are reported of a Department of Defense study, conducted pursuant to the U.S. Metric Study Act, to determine and evaluate the advantages and disadvantages, including impact on operational capability, that would attend adoption of the International System of Units of weights and measures for use in the Department (DoD). Cost estimates for each of the major components of the DoD of transition to metric system usage are included. In addition to discussing the specific advantages and disadvantages that would be expected within the Department, the dependence of the DoD on the national industrial base is described and how this interaction would be involved in a national metrication effort is discussed. Author

N71-32731*# National Oceanic and Atmospheric Administration, Rockville, Md. BOMAP Office.
BOMEX BULLETIN, NO. 10
Jun. 1971 87 p refs Sponsored in part by NASA, AEC, DOC, DOD, NSF, DOT, and Dept. of Interior
(NASA-CR-119764) Avail: NTIS

CONTENTS:

1. BOMEX PARTICIPANTS INFORMATION EXCHANGE p 1-30 refs (See N71-32732 19-34)

2. RESULTS FROM THE BOMEX CORE EXPERIMENT INTERIM REPORT J. Z. Holland p 31-43 refs (See N71-32733 19-34)

3. BOMEX ATMOSPHERIC MASS AND ENERGY BUDGETS: PRELIMINARY RESULTS E. M. Rasmusson p 44-50 ref (See N71-32734 19-20)

4. THREE DIMENSIONAL MODEL OF PRECIPITATION ECHOES FOR X-BAND RADAR DATA COLLECTED DURING BOMEX M. D. Hudlow p 51-62 refs (See N71-32735 19-20)

5. A TECHNIQUE FOR ASSESSING PROBABLE DISTRIBUTIONS OF TROPICAL PRECIPITATION ECHO LENGTHS FOR X-BAND RADAR FROM NIMBUS 3 HRIR DATA W. D. Scherer and M. D. Hudlow p 63-68 refs (See N71-32736 19-20)

6. ANALYSIS OF RADIOSONDE HUMIDITY ERRORS BASED ON BOMEX DATA H. L. Crutcher, L. D. Sanders, and J. T. Sullivan p 68–76 refs (See N71-32737 19-20)

7. TEMPORARY BOMEX DATA ARCHIVE p 77–84 refs (See N71-32738 19-34)

N71-32732*# National Oceanic and Atmospheric Administration, Rockville, Md.

BOMEX PARTICIPANTS INFORMATION EXCHANGE

In its BOMEX Bull., No. 10 Jun. 1971 p 1–30 refs (See N71-32731 19-34)

Avail: NTIS

The information presented has been furnished by BOMEX participants. Notes on results, novel techniques, problems, plans, and critiques pertain to oceanographic and meteorological investigations of sea-air interactions over tropical waters near Barbados. Author

N71-32733*# National Oceanic and Atmospheric Administration, Rockville, Md. BOMAP Office.

RESULTS FROM THE BOMEX CORE EXPERIMENT Interim Report

Joshua Z. Holland *In its* BOMEX Bull., No. 10 Jun. 1971 p 31–43 refs (See N71-32731 19-34)

Avail: NTIS

The Barbados Oceanographic and Meteorological Experiment (BOMEX) Sea-Air Interaction Program was conducted during May and June 1969. Ships, aircraft, satellites, and other platforms were used for the observations, with the objective of obtaining accurate measurements of the sea-air transfer of mass, energy, and momentum over an area representative of a single synoptic grid interval and located east of Barbados. Emphasis was given to the accurate measurement of the air-sea energy flux, the principal component being the latent heat of vaporization. Three independent estimates were compared: (1) the heat loss from the ocean based on analysis of the oceanographic data; (2) the terms of the water vapor continuity equation integrated over the atmospheric volume computed by means of the Gauss divergence theorem; and (3) the vertical flux of the water vapor as determined by correlation of high frequency turbulent fluctuations of vertical velocity and humidity measured in the atmospheric surface layer, as well as budgets of heat, mechanical energy, and momentum. Author

N71-32738*# National Oceanic and Atmospheric Administration, Rockville, Md.

TEMPORARY BOMEX DATA ARCHIVE

In its BOMEX Bull., No. 10 Jun. 1971 p 77–84 refs (See N71-32731 19-34)

Avail: NTIS

To receive, conserve, and disseminate BOMEX data, a special archive was established. Data that had been sufficiently processed, reduced, and documented were transferred from the BOMAP office to the temporary archive. Supplementary items that have been deposited in the archive since the initial announcement are: (1) Fixed-ship salinity/temperature/depth and sea surface temperature data; (2) Island, Discoverer, Air Force WB-47, Navy WC-121, RFF DC-6 39C, RFF DC-6 40C, and RFF DC-4 82E radar data; and (3) RFF aircraft cloud photography data. Author

N71-32740# General Accounting Office, Washington, D.C. Office of the Comptroller General of the United States.

OVERSTATEMENT OF CONTRACT TARGET COST FOR FIRST STAGE OF SATURN 5 LAUNCH VEHICLE; B-161366, NATIONAL AERONAUTICS AND SPACE ADMINISTRATION Report to the Congress

Elmer B. Staats 26 Oct. 1970 30 p refs

Avail: NTIS

An examination to determine the cause of target cost undermn for the first stage of Saturn 5 launch vehicle was conducted. The examination included certain materials cost and indirect costs which were overstated by the contractor. Conclusions show that the contract target cost was overstated because the contractor did not adjust its proposals to eliminate the cost of excessive quantities of certain materials, or recognize certain cost pricing data was available before the dates of its pricing certificates. E.H.W.

N71-32749# National Bureau of Standards, Washington, D.C.

US METRIC STUDY. FEDERAL GOVERNMENT: CIVILIAN AGENCIES Interim Report

Jul. 1971 323 p refs 2d in a ser. of Rept. prepared for the Congress

(NBS-SP-345-2) Avail: SOD $2.25

The findings of a survey to ascertain the views of the civilian agencies of the Federal Government on the issues raised by the U.S. Metric Study Act are reported. With regard to internal operations of the Federal agencies, metric (International System of Units, or SI) usage and its advantages and disadvantages, expectations of future changes in measurement usage if the U.S. continues its laissez faire policy toward the SI, and attitudes toward a possible nationally coordinated metrication program are covered. Estimates are given of added cost or savings impacts on agency internal operating budgets to be expected from a nominally 10-year planned metrication program, both during the transition and thereafter. The survey also assessed the impacts of metric usage and of its increase on the areas of responsibility of the Federal agencies in the society at large (e.g., communications, science and technology, health, labor affairs, international affairs, and trade), and on the agencies' interfaces therewith. Author

N71-32751*# Environmental Science Services Administration Rockville, Md. BOMAP Office.

BOMEX BULLETIN, NO. 6

Mar. 1970 68 p Sponsored in part by NASA, AEC, DOC, DOD, NSF, DOT, and Dept. of Interior

(NASA-CR-119760) Avail: NTIS CSCL 05B

CONTENTS:

1. BOMAP PLAN OF WORK p 1–41 (See N71-32752 19-34)

2. BOMEX PARTICIPANTS INFORMATION EXCHANGE p 42–60 (See N71-32753 19-13)

3. MISCELLANEOUS NOTES p 62–63 (See N71-32754 19-34)

N71-32752*# Environmental Science Services Administration, Rockville, Md.

BOMAP PLAN OF WORK

In its BOMEX Bull., No. 6 Mar. 1970 p 1–41 (See N71-32751 19-34)

Avail: NTIS CSCL 05B

An outline of the BOMAP (Barbados Oceanographic and Meteorological Analysis Project) plans for the BOMEX core experiment analysis, BOMEX statistical analyses, and BOMEX data processing is presented. Author

N71-32754*# Environmental Science Services Administration, Rockville, Md.

MISCELLANEOUS NOTES

In its BOMEX Bull., No. 6 Mar. 1970 p 62–63 (See N71-32751 19-34)

Avail: NTIS CSCL 05B

Miscellaneous data concerning BOMAP are presented. Included are the establishment of BOMAP advisory panel, examples of

problems to be studied in BOMEX, and planned conferences on tropical meteorology. F.O.S.

N71-32755*# Environmental Science Services Administration, Rockville, Md. BOMAP Office.
BOMEX BULLETIN, NO. 7
Jul. 1970 36 p refs Sponsored in part by NASA, AEC, DOC, DOD, NSF, DOT, and Dept. of Interior
(NASA-CR-119761) Avail: NTIS CSCL 05B

CONTENTS:
1. ABSTRACTS OF BOMEX RELATED PAPERS p 1–12 refs (See N71-32756 19-34)
2. HIGH LEVEL CLOUD PHOTOGRAPHY SAMPLES p 13–18 (See N71-32757 19-14)
3. RADAR DATA SAMPLE PRODUCTS p 19–24 (See N71-32758 19-07)
4. STATUS OF DATA PROCESSING AND REDUCTION (15 JUNE 1970) p 25–34 (See N71-32759 19-08)

N71-32756*# Environmental Science Services Administration, Rockville, Md.
ABSTRACTS OF BOMEX RELATED PAPERS
In its BOMEX Bull., No. 7 Jul. 1970 p 1–12 refs (See N71-32755 19-34)
Avail: NTIS CSCL 05B
Abstracts are presented of conference papers on: the preliminary results and analyses from BOMEX, and the methods and techniques used to collect data during the project. D.L.G.

N71-32760*# National Oceanic and Atmospheric Administration, Rockville, Md. BOMAP Office
BOMEX BULLETIN, NO. 8
Oct. 1970 72 p refs Sponsored by AEC, DOC, DOD, NASA, NSF, Dept. of Interior, and DOT
(NASA-CR-119762) Avail: NTIS CSCL 05B

CONTENTS:
1. BOMEX PARTICIPANTS INFORMATION EXCHANGE p 1–36 refs (See N71-32761 19-34)
2. STATUS OF BASIC DATA REDUCTION AND PROCESSING p 37–40 (See N71-32762 19-08)
3. SAMPLES AND FORMAT OF REDUCED DATA p 41–64 (See N71-32763 19-20)
4. BOMEX DATA INVENTORY AND DATA AVAILABILITY p 65–70 (See N71-32764 19-34)

N71-32761*# National Oceanic and Atmospheric Administration, Rockville, Md.
BOMEX PARTICIPANTS INFORMATION EXCHANGE
In its BOMEX Bull., No. 8 Oct. 1970 p 1–36 refs (See N71-32760 19-34)
Avail: NTIS CSCL 05B
One hundred experiments are cited, along with the principal investigators and current status and progress. These experiments are mainly concerned with various aspects of the atmosphere and their relation to the sea surface. J.A.M.

N71-32764*# National Oceanic and Atmospheric Administration, Rockville, Md.
BOMEX DATA INVENTORY AND DATA AVAILABILITY
In its BOMEX Bull., No. 8 Oct. 1970 p 65–70 (See N71-32760 19-34)
Avail: NTIS CSCL 05B
Data inventory and availability are discussed for a sea–air interaction study and for tropical convective systems study. A description of all aquisition platforms and their location, associated data subsystems, and actual parameters are briefly cited. J.A.M.

N71-32765*# National Oceanic and Atmospheric Administration, Rockville, Md. BOMAP Office.
BOMEX BULLETIN, NO. 9
Jan. 1971 122 p refs Sponsored by AEC, DOC, DOD, NASA, NSF, Dept. of Interior, and DOT
(NASA-CR-119763) Avail: NTIS CSCL 05B

CONTENTS:
1. TEMPORARY BOMEX DATA ARCHIVE p 1–85 refs (See N71-32766 19-34)
2. BOMEX PAPERS AND PUBLICATIONS p 86–98 refs (See N71-32767 19-34)
3. FLORIDA STATE UNIVERSITY'S PARTICIPATION IN BOMEX p 99–120 refs (See N71-32768 19-34)

N71-32766*# National Oceanic and Atmospheric Administration, Rockville, Md.
TEMPORARY BOMEX DATA ARCHIVE
In its BOMEX Bull., No. 9 Jan. 1971 p 1–85 refs (See N71-32765 19-34)
Avail: NTIS CSCL 05B
Effective February 1, 1971, a temporary BOMEX archive will be operational to service requests for some 26 processed BOMEX data products. The temporary archive represents data selected by BOMAP that were acquired from the fixed-ship, aircraft, and island-based acquisition systems under the operational control of the BOMEX Field Headquarters. Author

N71-32767*# National Oceanic and Atmospheric Administration, Rockville, Md.
BOMEX PAPERS AND PUBLICATIONS
In its BOMEX Bull., No. 9 Jan. 1971 p 86–98 refs (See N71-32765 19-34)
Avail: NTIS CSCL 05B
Listed below are papers presented by BOMEX participants at scientific meetings, internal BOMEX publications, and journal articles dealing exclusively with the various experiments. Also included are miscellaneous BOMEX-related papers. The scientific journals containing the abstracts of papers presented at meetings are cited wherever possible. Author

N71-32768*# National Oceanic and Atmospheric Administration, Rockville, Md.
FLORIDA STATE UNIVERSITY'S PARTICIPATION IN BOMEX
In its BOMEX Bull., No. 9 Jan. 1971 p 99–120 refs (See N71-32765 19-34)
Avail: NTIS CSCL 05B
A multiscale observational program in which simultaneous measurements in the atmospheric boundary layer, the region of dry convection between the boundary and cloud bases, and in and above the cloud layer would be made is described. Indications are that such measurements would permit a quantitative description of scales of motion in each of these atmospheric layers and lead to insight into their interaction and role in atmospheric energy transfer. The measurements were taken from the eastern most part of the Lesser Antilles. Author

N71-32775*# National Aeronautics and Space Administration, Washington, D.C.
SPACE AND INTERNATIONAL LAW

A. S. Piradov Aug. 1971 62 p refs Transl. into ENGLISH of the publ. 'Kosmos i Mezhdunarodnoye Pravo' Moscow, Znaniye Press, 1970 p 1–62
(NASA-TT-F-13751) Avail: NTIS CSCL 05D

The Soviet analysis of space law as an independently developing branch of international law was presented. Fundamental problems and the prospects for the development of space law were considered. The provisions of the articles in the Treaty on Principles of National Activity in Exploration and Use of Space, Including the Moon and Other Celestial Bodies, and other space law agreements were discussed. J.G.M.

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EUROPEAN

An extensive collection of NASA and NASA-sponsored publications is maintained by the National Lending Library for Science and Technology, Boston Spa, Yorkshire, England. By virtue of arrangements other than with NASA, the National Lending Library also has available many of the non-NASA publications cited in *STAR*. European requesters may purchase facsimile copy or microfiche of NASA and NASA-sponsored documents, those identified by both the symbols "#" and "*", from: ESRO/ELDO Space Documentation Service, European Space Research Organization, 114, av. de Neuilly, 92-Neuilly-sur-Seine, France.

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NEW NASA PUBLICATIONS

Hydrogen Line Blanketed Model Stellar Atmospheres (NASA SP–3065)

By D. A. KLINGLESMITH

This compilation of theoretical results provides an internally consistent set of model atmospheres that can be used for comparison with observations. Enough data on the depth-dependent quantities are given so that other quantities can be computed easily. The observable quantities—monochromatic emergent fluxes, discontinuities, continuum slopes, UBV and uvby colors, and equivalent width and central intensity of Hγ—are presented. *Paperbound.* 268 pp. Available from the National Technical Information Service, Sprinfield, Va. 22151, for $3.00.

The Entry Plasma Sheath and Its Effects on Space Vehicle Electromagnetic Systems. Vol. I (NASA SP–252)

The unclassified portion of the proceedings of a symposium held at Langley Research Center, October 13–15, 1970. The papers cover theoretical and experimental results of research and flight tests of many different specific aspects of the general problem of plasma sheath degradation of reentry vehicle electromagnetic systems. Information concerning access to Vol. II (NASA SP–253) and Vol. III (NASA SP–254) may be obtained in CSTAR *(Classified Scientific and Technical Aerospace Reports). Paperbound.* 632 pp. Vol. I is available from the National Technical Information Service, Springfield, Va. 22151, for $9.00.

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